READING PERFORMANCE OF NORMALLY SIGHTED AND PARTIALLY SIGHTED THIRD AND FOURTH GRADE STUDENTS...

O. Morris, 1973

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READING PERFORMANCE OF NORMALLY SIGHTED AND PARTIALLY SIGHTED THIRD AND FOURTH GRADE STUDENTS USING REGULAR PRINT AND LARGE PRINT

A Thesis
Submitted to the Faculty of the Graduate School
of the University of Minnesota

by
Ouida Fae Morris

In Partial Fulfillment of the Requirements
for the Degree of
Doctor of Philosophy

December 1973

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CHAPTER I

INTRODUCTION

The Problem

Traditionally large print textbooks and other educational materials have been routinely provided for partially sighted students. This practice originated in an era when classes for these children were called sight-saving classes and the instructional philosophy was to save the little sight the student had rather than use it. It was believed that reading at close distances to the eye was harmful. The original reason for developing large print materials was so that the person with a visual handicap could read materials held 14 to 30 inches from the eyes.

Ophthalmologists now agree that it is neither harmful to read at close distances to the eyes, nor to use whatever remaining vision a patient has (Fonda, 1970). This reversal of medical opinion has resulted in some revolutionary changes in educational practices with visually handicapped students. In the past legally blind students were taught to read braille as a matter of policy (Jones, 1961). Currently education of the visually handicapped is experiencing a nationwide thrust to teach children to use their residual vision to the

fullest. Students who can see print are taught to read print. Twenty years ago, the majority of the partially sighted subjects from this sample, those who are legally blind, would not have been reading print at all. In recent years many partially sighted students including those who are legally blind, have successfully used regular print materials. These factors indicate the need for a re-evaluation of the use of large print with partially sighted students.

The teacher of partially sighted students faces a unique problem--he must participate in the educational decision regarding the print size the student will read. At the present time there is no diagnostic tool which the teacher may use to aid in this specific decision. The present study, which compared students' performances on the regular and large print editions of a standard oral reading test, provides the opportunity to examine the feasibility of using this method of testing for possible diagnostic purposes. If such a method of diagnosis, using materials readily available to a teacher of partially sighted students could be designed, it could assist the teacher in making the decision of the print size appropriate to an individual student's needs.

The Present Study

The purpose of the present study was to investigate the effect of print size on the reading performance of normally sighted and partially sighted third and fourth grade students. Forms A and B, of the Gilmore Oral Reading Test (1951) was administered to every subject, Form A in the standard edition and Form B in a large print edition. Each form of this test consisted of a series of graded paragraphs which the subject read orally and then answered comprehension questions on each paragraph. The reading was timed and a record of errors made. Scores were calculated on 12 factors of reading performance: accuracy, comprehension, rate, substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, omissions, and total errors.

The hypotheses state that the reading performance on the regular print test does not differ from the reading performance on the large print test for normally sighted subjects or for partially sighted subjects. For both groups of subjects the reading performance on the regular print test relates positively to the same factor of reading performance on the large print test. The effect of print size does not differ for normally sighted subjects. A full statement of each hypothesis is given in Chapter III.

Definitions

Problems in the applicability and generalizability of research findings frequently arise because of differences in definition or application of terms. In order to avoid ambiguity which may obscure results reported, the following definition of terms as used in the present study are given.

Partially sighted student--one who has a corrected visual acuity of 20/70 or less in the better eye and reads print, either regular print or large print as his primary educational tool.

Normally sighted student--one who has a corrected visual acuity of 20/50 or better in the poorer eye. In the present study the Snellen Test Chart was used as a screening instrument to identify normally sighted subjects.

Legally blind--having a visual acuity of 20/200 or less in the better eye with the best possible correction or an angle of vision of 20° or less.

Regular print edition--the standard edition of the Gilmore Oral Reading Test.

Large print edition--an enlarged copy of the Gilmore Oral Reading Test produced by photographing the regular edition and reproducing it in a prescribed size. In the present study the large print edition was reproduced so

that the smallest print in the reading paragraphs was 21 point type. The largest print was approximately 24 point type.

Type size is measured in "points." A point is defined as 1/72 of an inch with 12 points equal to one pica or 1/6 of an inch. A given point size is the precise amount of vertical space occupied by a complete line of type....typewriter type is not regulated by typographic type sizes (Eakin, 1960, p. 3).

Visual acuity--as defined by Webster--the ability of the eye to discriminate detail normally tested by comparison with the power of the normal eye to distinquish certain letters on a standard chart at a given distance, generally 20 feet.

Visual acuity is recorded as a fraction. The numerator represents distance from the chart; the denominator represents the line read. 20/200 indicates that the person reads at 20 feet the line which should be read at a distance of 200 feet.

Snellen Test Chart--used for testing central visual acuity. It consists of lines of letters, numbers or symbols in graded sizes drawn to Snellen measurements. Each size is labeled with the distance at which it can be read by the normal eye. Most often used for testing vision at distance of 20 feet (National Society for the Prevention of Blindness, 1967).

Reading performance--reading accuracy, reading comprehension, reading rate and the following types of errors: substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, and omissions, as measured by the Gilmore Oral Reading Test.

Comprehension--the Comprehension Score on the Gilmore Oral Reading Test, based on the ability to answer five comprehension questions on each paragraph read.

Accuracy--the Accuracy Score on the Gilmore Oral Reading Test.

Reading rate--the words per minute which the subject read, calculated by dividing the number of words read by the reading time in seconds, then multipling by 60.

Errors--the following eight types of errors were recorded in the administration of the Gilmore Oral Reading Test. The manual of directions defines each of the error types.

> Substitution--a sensible or real word substituted for a word in the paragraph.
> Mispronunciation--a nonsense word which may be produced by (1) false accentuation, (2) wrong pronunciation of vowels or consonants, or (3) omission, addition or insertion of one or more letters.
> Word pronounced by examiner--a word on which subject hesitates for 5 seconds. The word is then pronounced by the examiner.
> Disregard of punctuation--failure to observe punctuation.
> Insertion--a word (or words) inserted at the beginning, in the middle, or at the end of a sentence or line of text.

Hesitation--a pause of at least two seconds before pronouncing a word.
Repetition--a word, part of a word, or group of words repeated.
Omission--one or more words omitted.
(Gilmore, 1952, pp. 8-9)

Summary

The present study investigated the reading performance of normally sighted and partially sighted third and fourth grade students. Each subject was administered an oral reading test, one form in the regular print edition and one form in the large print edition. Twelve factors of reading performance were measured: accuracy, comprehension, rate, total errors, and eight specific error types. The statistical procedures examined the effect of the print size on the normally sighted and partially sighted subjects and compared the effects of the change in print size on the two groups.

CHAPTER II

REVIEW OF THE LITERATURE

This review will present first a discussion of practice and research on legibility, in particular print size, both for normally sighted and partially sighted persons followed by a brief discussion of research relating to error patterns in oral reading of normally sighted and partially sighted students, and rate and accuracy for partially sighted students.

The ease of reading printed matter has been variously labeled readability and legibility. For a period of time from the 1920's through the 1940's the term readability was used to denote ease and speed of reading. However, with the advent of "readability formulas" the term readability has come to refer to the difficulty level of reading materials. Therefore legibility has become the best term to use in order to avoid ambiguity. As used in this study legibility refers to factors which affect the ease, accuracy and speed of reading with understanding (Tinker, 1965).

A number of different factors influence legibility. Some of these factors are described below. Type size is measured in points, such as 10 point or 12 point type, one point being 1/72 inch. Type face refers to the style

of type, such as Plantin or Gill Sans. There are thousands of different styles, developed and chosen primarily on the basis of artistic value. These styles can be broken into two groups: serif and sans serif. Serifs are the fine cross strokes at the top and bottom of each of the individual letters comprising a type face. A preponderant amount of type in common use is designed with serifs. The weight or boldness of a type face affects its legibility. A particular style may be available in light, medium and bold. Leading is extra space between lines of print. It is measured in points. Type which is printed without leading is referred to as being set solid. The width of the line is measured in picas with one pica being 1/6 inch. The print may be in columns or go across the entire page.

The relationship of the type size, the leading and the line width has innumerable passible combinations. In actual practice the change of one often involves a change in the others. For example, a larger size type usually has greater width of line and more leading.

The spatial arrangement on the page can be varied. The page may be divided into columns or not. Another factor to consider is the preparation of printed area to white, or the sizes of the various margins. The color of the print and the background influence legibility. An especially important factor here is the contrast between the two.

These various factors were a part of the traditional printing process which involved the setting of metal type. However, modern developments in the printing industry have altered these. Offset lithography uses a photographic negative to produce the printing plate thus altering the framework of restraints and possibilities from which the printer works. This is particularly true in using points to measure type and leading. Metal type comes in standard sizes such as 10, 12, 14, and 18 point. The size of print can be photographically reduced or enlarged into an infinite number of sizes without being limited to those sizes commonly available in metal type. In addition to the use of offset lithography for the mass production of books, educators of the partially sighted commonly order large print books custom-made for individual students. Microfilm companies can photograph the necessary book and print as small a number as one copy enlarged to the specific size ordered. In this case all the characteristics of the original page are enlarged, including crowded or widely spaced lines, easily legible or poorly legible type face, or imperfectly formed letters.

Much research has investigated these various factors of legibility. However, the factor which has received the greatest attention, for the normally sighted population and especially for partially sighted students, is

type size. From the time of the establishment of the very first classes for partially sighted children the concern for large print was expressed (Hathaway, 1953). Only research on type size, both in the general population and for the partially sighted will be examined. This is done with the realization that it is only one factor among many which influence legibility.

Legibility for the Normally Sighted

Studies of legibility of type size with normally sighted adults will be reviewed, followed by a discussion of studies relating to type size in books for primary school children.

Gilliland (1923) studied the effect of print size on reading. Two sets of reading paragraphs were used. Set 1 was printed in sizes 6, 9, 12, 18, 36, and 54 point with line width of 1-1/6, 2-1/2, 3-1/3, 5, 10, and 15 inches. Set 2 was printed in 3, 4, 6, 12, 18, 36, 54, 72 and 90 points with line width corresponding to the first set. Each paragraph was photographically reduced or enlarged to 12 point type. The subject read a paragraph in one of the various print sizes, then immediately re-read the same paragraph in 12 point type. The reading was silent. Time was recorded and eye movements were photographed to study the number, length, and

position of fixations. The longer series of paragraphs was read by 24 adults while 21 adults read the shorter series. In addition, 33 adults read another series of paragraphs printed in 90, 12, and 3 point, in which time was recorded. Gilliland found there were many variations from the average. Some subjects were retarded by the small type but not the large. Still others were slowed down by the large type and not so much by the small. Some were affected by both large and small type. In general, good readers with normal eyesight were somewhat slowed down by type as large as, or larger than, 36 point and by type 6 point or smaller. Four of his subjects were found to have defective vision (unspecified). They were slowed down by the small type.

The easiest set of paragraphs were read by 19 third grade children, 24 fourth grade children and six fifth grade children. They were not so greatly affected as adults by changes in the size of the type.

Pyke (1926) reviewed the research to that time on legibility including print size and conducted some experiments. His experiments did not deal with print size as an isolated factor. In fact, size seems not to have been varied. He concluded that extremely large typographical differences must be present before it is possible to say that there is any difference in the objective legibility of types. Types with less differentiation will be legible according to the way they suit the psychological

make-up of the reader, so that the most legible type, in this subjective sense, is not likely to be the same for all readers.

Hovde (1929, 1930) tested the relative effects of type size and leading in the range of print sizes used in newspapers. Sixteen different combinations of print size and leading were used. Sizes of print from 6 to 8 point were used with leading ranging from set solid to 1 point. Excerpts from Charles A. Lindbergh's We were printed in 16 columns, one for each of the tested combinations. Three groups of 100 male college students participated. Reading rate and the expressed preference of the subjects were the criteria. The preferences of the subjects seldom agreed with their best reading rates. Two conclusions were reached from this experiment: a) reading rate is influenced by context more than by size of type or leading, and b) the sensory content is the basis of the readers' preferences and opinions of legibility.

Tinker (1963) reports on his research in the area of legibility spanning a period of thirty years. A number of his studies investigate the effect of the size of type. Paterson and Tinker completed two studies of the influence of type size on legibility of print employing their speed-of-reading method. Three hundred twenty college students read materials in 6, 8, 10, 12

and 14 point type. Material was set solid with a line width of 19 picas. Ten point was the standard against which the other sizes were compared. All the sizes were read significantly more slowly than 10 point.

A repeat of the experiment with 8, 9, 10, 11, and 12 point set solid with a 19 pica line used 475 subjects. Again 10 point type was the standard of comparison. The 8 point was read significantly more slowly than 10 point. Eleven point was read significantly faster than 10 point type. No other differences were significant.

In another study Paterson and Tinker analyzed the eye movement patterns of subjects reading 6, 10, and 14 point type. Results indicate greater efficiency of aculomotor patterns for 10 point than for either 6 point or 14 point. The researchers suggest that the reduction in efficiency for the 6 point type was largely due to reduced visibility of the smaller type and the reduced efficiency for 14 point was due to the increased amount of printing area to be covered in reading.

Size of type must be coordinated with leading and width of line to determine optimum legibility. The range of findings from a series of studies by Tinker illustrates the interrelatedness of one factor with another. One study asked if 10 point set solid is more

difficult to read than 8 point with 2 point leading. Two hundred subjects read these materials printed on a 19 pica line. The two printing arrangements were equally legible. Other things being equal, 10 point type is more legible than 8 point type. Thus this experiment may be seen as additional proof of the value of 2 point leading for 8 point type.

The findings from a number of these studies are summarized below. It appears that a shift from 10 point to 11 point allows the use of a larger variety of line widths without loss of legibility. Apparently the detrimental effect of relatively short (17 picas) and of relatively long (33 picas) lines can be counteracted by the use of some leading. There is a trend that as the size of type increases above 10 points (11 and 12 points) width of line and leading become less important. Readers prefer print with some leading, and readers dislike very short and very long lines. Leading plays an important role in legibility and allows the printer to use a larger range of line widths.

In Great Britain the British Association for the Advancement of Science appointed a committee on "School Books and Eyesight" in 1912. Their report issued in 1913 (Report of the Committee of Inquiry into Problems Relating to Partially Sighted Children, 1934) does not appear to be based on actual experiments. However, they

make recommendations regarding size, among other factors. The recommended minimum height of face of short letters was: under 7 years of age, 3.5mm.; 7-8 years, 2.5 mm.; 8-9 years, 2.0 mm.; 9-12 years, 1.8 mm.; and over 12 years, 1.58 mm. or 1/16 inch. One point equals 1/72 inch or 0.35 mm. The measurement is given in millimeters rather than in printers' terminology using points.

Size of type as related to readability or legibility in the first four grades was investigated by Blackhurst (1922). Forty first grade children read materials printed in 14, 18, 24 and 30 point type. Fifty second grade children read 10, 12, 14, 18, and 24 point type. One hundred third and fourth grade children read 8, 10, 12, 14, and 18 point type. The criteria in the investigation were reading speed and number of errors. He found that for first grade 24 point type had the lowest time and errors. Both time and errors increased as print size moved away from 24 point. Twenty-four point was judged best for second grade. Eighteen point was judged the most readable for third and fourth grade.

The Textbook in American Education was the topic of the Thirtieth Yearbook of the National Society for the Study of Education in 1931. Buckingham investigated typography of textbooks for this yearbook report. His review of the literature indicated that then current

practice in printing children's textbooks was based primarily on a 1902 report by Shaw in School Hygiene. How Shaw had obtained his recommendations was not apparent. Again the size of type and leading was not given in printer's terms. In addition the sizes he used don't correspond to commonly used type sizes. By leading Shaw appears to have meant interlinear spacing. Shaw's recommendations for minimum type size and leading in millimeters are: first grade, 2.6-4.5; second grade, 2.0-4.0; third grade, 2.0-4.0; fourth grade, 1.8-3.6; and above fourth grade, 1.6-3.0.

Buckingham's study (1931) investigated the effect of various combinations of type size, leading and line width on the reading of 779 second grade students. With the criteria of reading speed and comprehension the sizes of type, rated best to worst were, 12, 14, and 18 point. In a later study, Buckingham (1933) tested the type sizes of first grade textbooks for readability or legibility. Three hundred six first graders were subjects with reading speed as the criteria. Twelve point type was found to be best. The other sizes, 14, 18, and 24 point showed little difference in reading time.

McNamara, Paterson and Tinker (1953) studies the effect of variation in type size upon the speed of reading by children in grades 1 through 3. Test materials printed in 8, 10, 12, 14, 18, and 24 point type

were used with 3,050 pupils. In grades 1A and 2B variations in size of type had little consistent effect on speed of reading. In grade 2A there was no differential effect of type size or a slight advantage for 14 point. In grade 3B, there was a prominent trend for faster reading of material set in 10, 12, and 14 point type, particularly 10 and 12 point. The authors suggest that type size is a relatively unimportant factor, as far as effect on reading speed is concerned, during the first two grades when the reading skill is developing.

Gilliland (1923) working with normally sighted subjects and Shaw (1969) studying partially sighted subjects found that children were not so greatly affected by changes in the size of type as were adults. At least for Shaw's subjects who were tested with type sizes near the smallest each subject could read, the greater ability of the younger eye to accomodate may account for these differences.

Zachrisson (Demilia, 1968) found that first grade children preferred 16 point over 10 and 14 point. Fourth grade students preferred 12 point over 8 point.

The wide variability in the findings of these various studies with children is in part due to the fact that the studies used different ranges of type sizes. In some cases the size found best in one study was not among the

options in other studies. Of perhaps greater importance is the effect of the combination of type size, leading, line width and type face style which differed from study to study. Gilliland and Shaw's findings that children are less affected by changes in type size undoubtedly is another factor influencing these results.

Tinker, Paterson and Tinker (1963) investigated the adequacy of different lengths of reading periods in demonstrating the effects of typographical factors upon speed of reading. They found that

> any effects of typographical factors upon speed of reading found for brief work periods of 1-1/2 or 1-3/4 minutes hold for longer periods up to 30 minutes. Periods of 1-3/4, 5-3/4 and 10, or 4 to 16, or 10 to 30 minutes, all show the same trend. Any differences found for a short period hold or increase slightly for longer periods of work. One may safely conclude from these studies that reading for relatively short periods yields a valid measure of legibility (p. 27).

Eye strain or fatigue has from the start been one of the major concerns of educators of the partially sighted. When the classes first began the source of this concern was the belief that eye strain could produce permanent eye damage. This was one of the major reasons for the introduction of large print books. At the present time educators' concern with eye strain is the fatigue which it can cause. This does not harm the eyes, but is excessively tiring for the student and thus is to be avoided.

An examination of the literature indicates that the most commonly used method for measuring fatigue in reading is the involuntary eye-blink rate developed by Matthew Luckiesh and Frank K. Moss (Fortner, 1943; McNally, 1943; Tinker, 1963; Sykes, 1971) who were at the time technicians at the General Electric Lighting Research Laboratory, Nela Park, Cleveland, Ohio. Eye-blinks are counted by direct observation for a period of five minutes while the subject is reading continuous text under each of the various conditions being tested. The assumption is that any factor which reduces ease of seeing will increase frequency of involuntary blinking. A number of researchers including Tinker (1963) have attempted unsuccessfully to validate the blink technique as a measure of legibility. Therefore, it appears that involuntary eye-blink can not be accepted as a valid measure of legibility or fatigue. Tinker (1965) and Shaw (1969) report that no satisfactory method of measuring visual fatigue has been devised. A search of the literature has not revealed the development of any such measures. In the light of these findings no measure of visual fatigue is included in the present study.

Type Size for the Partially Sighted

An examination of the history of education for partially sighted children offers the opportunity to contrast early educational practices to contemporary practice. The first class specifically for partially sighted children was started in 1908 at South London. The earliest emphasis in such classes was to use oral work in order to avoid use of the eyes required for reading and writing. The practice is evidenced by the sign over the door of this first class, "Reading and Writing Shall Not Enter Here" (Hathaway, 1953).

Small amounts of reading and writing soon entered the curriculum even in the first class and subsequent classes such as the first class in the United States established in Roxbury, Massachusetts in 1913. Students were given materials with large hand lettering or printed with large rubber stamp sets. In 1917, after classes were started in Cleveland, Ohio, Robert B. Irwin pioneered printed textbooks for sight-saving classes, as classes for partially sighted students were called. The first texts were in 36 point type. Twenty-four point was found to be suitable for the students and was more practical. Irwin's studies will be discussed later.

A major concern in the classes for partially sighted children was "sight-saving." The need for large print

books and minimal use of the eyes is illustrated by this list of suggestions for classroom teachers who have partially sighted students in their classes given in a 1933 pamphlet of the United States Government Printing Office by Beatrice McLeod, Senior Specialist in the Education of Physically Handicapped Children, Office of Education,

1. Secure large-type readers for the sight defective child as basic material for use in developing his reading ability.
2. Limit his reading to the informational type and let reading for pleasure be minimized until improvement of eye condition takes place.
3. Use much oral reading of stories, both by the teacher and by normally seeing pupils in the class.
4. Encourage parents, brothers, and sisters to read aloud at home.
5. Do not permit the child to go to the library for books for outside reading.
6. Substitute other activities to take the place of his desire for reading, such as dramatics, garden work, and games.

(McLeod, 1933, p. 21)

At the time when sight-saving classes were being established it was believed that use of the eyes would aggravate ocular disorders, especially myopia. Students who were legally blind were placed in schools or classes for the blind and taught to read braille so as to avoid reading with the eyes. Students in sight-saving classes were given large print books to avoid eye strain and to conserve vision. Large print books were seen as a way to avoid eye fatigue which was a particular concern,

as a cause of permanent harm to the eyes.

The Report of the Committee of Inquiry into Problems Relating to Partially Sighted Children published in London in 1934 states that the prevailing practice was to prohibit reading except from very large hand-printed type. This committee differentiates between myopes and non-myopes and states that only myopes need restrictions on reading. The committee recommends that students with only a moderate degree of myopia uncomplicated by serious fundus changes should be allowed to read materials that they can easily see from a distance of about 14 inches provided that they didn't stoop or read long enough to cause ocular discomfort or fatigue. The recommendations are apparently based on a review of research and logical examination of print faces rather than on experiments of its own. The committee recommends that books be used very sparingly with partially sighted children under the age of eight with teaching in the main done with blackboard writing and large hand-printed materials. Readers for these children should be 24 point type. Books for older children with a severe defect may need 24 point. Students may make limited use of smaller type for very short periods.

At the present time education of the partially sighted has experienced several changes in these practices as a result of changes in medical opinion. No longer is use of the eyes felt to be harmful. A reading distance of 14 inches is not thought to be essential and students are allowed to read at whatever distance they find best. Eye fatigue is a concern as a temporary condition which tires the student, rather than as a condition which may cause permanent damage. Two changes in practice relating to mode of reading are: a) students who previously would have been taught to read braille are now taught to read print, either large print or regular print, and b) students are increasingly using regular print materials rather than large print.

Fonda (1966, 1970), an ophthalmologist, writes concerning the reading of braille, large print and regular print by partially sighted persons. He states, "No patient should be advised to learn to read braille if he can read type" (Fonda, 1970, p. 14). He suggests braille if distant vision is 2/200 or less. For patients with vision between 3/200 and 5/200 it is difficult to make a decision as to reading method. However, he prefers to advise the use of type. He also cites numerous points, medical, educational, and economic in favor of the use of regular print rather than large print.

A series of studies originated by Jones (1961) and replicated by Nolan (1963, 1967, 1971) examined the relationships between visual acuity, reading medium, grade level, and type of educational program for legally blind children. These studies were based on data gathered at the American Printing House for the Blind through registration of legally blind children under provisions of the federal act entitled "To Promote the Education of the Blind" as amended by Public Law 84-922. The 1969 study was based on data describing 19,879 children. The information from the studies, of interest here, relate to trends in use of braille, large print, and regular print as the reading medium. The studies show a shift away from braille reading. Proportions of students reported as braille readers were: 1960 - 58 percent; 1963 - 53 percent; 1966 - 46 percent; and 1969 - 39 percent. In 1960 and 1963, the possible categories given on the registration form were: braille, large type, or both braille and large type. In 1966, the number of possible reading categories increased from three to six; braille, large type, both braille and large type, large type and ink print (regular print), ink print, and auditory. This change in the registration form is itself an indication of change in thought and practice. The proportions of students reported as reading large type are: 1960 - 38 percent; 1963 - 43 percent; 1966 - 36 percent; and 1969 - 36 percent. Students reported

as using at least some ink print were first reported in 1966. The percentage rose from 11 percent in 1966 to 16 percent in 1969. The studies as a group show a general trend towards increased use of residual vision. The subjects in the Jones, Nolan studies were legally blind. These students would not have been included in the early sight-saving classes as they would have been in classes for the blind reading braille. (Fifteen subjects in the present study are legally blind.)

In 1919-1920, Irwin (Eakin, 1961) conducted a series of four studies to determine the size and style of print to use in large print textbooks for partially sighted students. The research findings were never published by Irwin. The data was taken from the files of the Department of Special Education, Cleveland Board of Education and reported by Eakin. Data was available only on the fourth of the four studies. Forty-two children, third grade and above, were given a test consisting of random words from a vocabulary list printed in a different order for each type. The seven types used were: 30 point Caslon Old Style, 24 point Caslon Bold, 24 point Caslon Light, 30 point Clear Face, 24 point Clear Face, 30 point Cloister Old Style and 24 point Century Schoolbook. The subjects read orally. One observer timed the reading with a stop watch and noted hesitations, repetitions, omissions, and mistakes. A second observer measured the

distance from the eye and watched for signs of squinting, scowling, and other indications of any effort to see. Subject remarks were also solicited. The performance on each type sample was ranked on eight criteria. Twenty-four point Century Schoolbook was best, ranking first on five of the eight criteria. Twenty-four point Caslon Bold ranked second. The researchers concluded that it wasn't necessary to consider 30 point and larger because of the poor showing of 30 point in this study.

Fortner (1943) conducted a study to compare the ease of reading material in 18 and 24 point type. The criteria were time and eye-blink. Counting the eye-blink was used as a measure of fatigue. Thirty-nine public school normally sighted children, grades 4-6, ages 9-14 read the test passage in 14, 18, and 24 point type. This group was labeled a control group. However, no statistical comparisons were made with the partially sighted experimental group. The experimental group was composed of 56 partially sighted children, grades 4-12, ages 9-18, with visual acuities of 20/20 to less than 20/200. The experimental group read 18 and 24 point type. Fortner found a trend for lower time and eye-blink rate as type size decreased, but the differences were not great enough to be significant.

McNally (1934) evaluated the legibility of certain types and type sizes for children with handicapped

vision. Seventy-two subjects were chosen from the sight-saving classes of New York City. Criteria for admission to the classes was 20/50 or less in the better eye with correction to 20/200 in the better eye with correction. Frequently students with vision better than 20/50 were admitted on recommendation of the ophthalmologist. The subjects were 9 to 14 years old in grades 4 to 8. The type sizes used were 12, 14, 18, and 24 point. Twelve point was chosen as the smallest size primarily because of the unwillingness of the authorities in charge of the classes used in the study to allow the pupils to read type smaller than this. McNally measured eye-blink rate and reading speed. There were no differences among type variations for reading speed or eye-blink rate. There was little or no relationship between reading speed and eye-blink rate. McNally suggests that reading speed is not sensitive enough as a measure of legibility and eye-blink rate may not be a valid criterion for fatigue.

Livingston (1958) carried out a study to determine whether enlarging the visually presented tests of the revised Stanford-Binet Intelligence Test would increase the scores of partially sighted children. Subjects were 60 children, ages 8 and 9, with visual acuities 20/70 to 20/200. Thirteen subjects had vision better than 20/70 in the better eye. All subjects were administered Form L of the test in standard form. Three months later the

experimental group (n=30) was given the test again in a photographically enlarged form and the control group (n=30) was given the standard form. The enlarged test did not produce significant gains in IQ.

Nolan (1959) investigated the readability of two type sizes and two type styles with partially sighted children. His subjects were 264 children, ages 8 years 9 months to 20 years 10 months, in grades 4-12. Visual acuities ranged from 20/20 to 20/200. The treatments were comparisons of type size, 18 and 24 point, and type style. Two levels of vision were legally blind and visual handicaps less severe than legal blindness. The criterion measure was reading speed with comprehension questions asked as a check. Nolan found that differences exist between the reading speeds for type style and visual levels. Groups with better vision read faster than those with poorer vision. In every case 18 point type was read faster than 24 point type, but the differences were too small to be statistically significant. Visually handicapped students studied could read both sizes of type with equal speed.

Stanwix House, Inc. (Eakin, 1961) conducted a study in 1952 to investigate the effects of visual acuity, reading age, and type size on reading speed. Three hundred seventy-three subjects were divided into nine groups. The subjects were divided into three sections

according to near visual acuity 14/14 to 14/34, 14/35 to 14/44, and 14/45 to 14/155. Each section was divided into groups which read 12, 18, and 24 point type. A reading frame was used to keep the reading material 14 inches from the eyes. The reading was oral with each test scored by the number of words read and the number of errors in the ten-minute testing period. An analysis of the results indicate that there is a significant increase in the number of partially sighted children who can see to read 24 point type at a reading distance of 14 inches when compared to the number who can see to read smaller type sizes. Reading was not any more accurate for one type size than for any other.

Mueller (1962) studied the effects of illustration size on the test performance of visually limited children. The subjects were 39 children, ages 8-16, with visual acuity 20/70 to 10/200. Subjects were administered the Peabody Picture Vocabulary Test, Forms A and B, one with the regular illustration size, 5 x 7, and the other with 8-1/2 x 11 illustrations, with two or three weeks between administrations. An earlier study had determined that plate size had no effect on the test performance of normally sighted children of preschool ages. Mueller found that subjects with 20/70 vision did not do significantly better with the larger plates.

The children with 20/200-10/200 vision did significantly better with the larger illustrations.

Birch (1966) investigated school achievement of partially sighted students and the effect of type size on reading in visually handicapped children. One thousand, eighty four partially sighted fifth and sixth grade students in 16 states participated in this study. The number of students who took four or five forms of the Metropolitan Achievement Test was 903. The MAT was administered to each subject in five type sizes over a four month period with a correction factor used to equate scores from the different times of administration. The type sizes were 12, 15, 18, 21, and 24 point type.

> Approximately four out of ten (43.4 percent) partially seeing children seem to need rather large type (21 and 24 point) in order to read most effectively. Another four out of ten (41.0 percent) can read much smaller type sizes (12 and 15 point) best. Neither of the two groups (eight out of ten or 84.4 percent) is best suited by 18 point type. The most general finding seems to be that no one of the type sizes can be considered superior to others with respect to optimum accommodation of partially seeing children in performing school-like reading tasks (Birch, 1966, p. 71).

These tests were used to determine the best type size for each child. The measure of school achievement was the Stanford Achievement Test, Form W, administered under timed and untimed conditions. Five hundred thirty-two nonhandicapped fifth and sixth grade students

took the Stanford Achievement Test under the same conditions. The researchers found that partially sighted students do demonstrate their achievement more adequately under conditions which reduce time pressure. However, under the most favorable conditions partially sighted sixth grade students earned achievement test scores whose median was one full grade below sixth grade children in general. The researchers concluded there is no general relationship between reading speed and comprehension and type size among partially sighted children. Reading speed and comprehension and visual acuity are not related in partially sighted children. Type size, achievement, and reading distance show no general relationship among partially sighted children.

Shaw (1969) investigated the effect on legibility of variations in type face, type weight or boldness, type size and type spacing, inter letter, inter word, and inter line. The type faces used were Plantin, a serif type, and Gill Sans, a san serif type. Medium and bold weights of each type face were used. The type sizes were 12, 14, 16, 18, 20 and 24 point. Four combinations of inter letter, inter word and inter line spacing were used. The objective was to determine the relative importance of the four factors rather than to establish absolute levels for optimal legibility for each factor. The criteria measured were: reading time, errors made, and visibility as determined by the visual

threshold of each subject, or the smallest print he could see to read. In addition the children were asked which print passage they preferred. The several variations of the typographical factors tested produced 32 different print combinations. Each subject read four print passages in the two print sizes nearest his visual threshold. For adults an increase in size produced 16 percent improvement in reading performance, increase in weight achieved nine percent improvement (although these two factors interacted to the extent that an increase in size of a light type improved reading performance more than the same size increase of a bold type) a change from a serif face (Plantin) to a sans serif face (Gill Sans) improved reading performance by four percent. The total effect of changing from the worst to the best type was an improvement of 35 percent. For children, size of type was the only factor found to be statistically significant; there was a five percent improvement in reading performance with increase in size. There was no correlation between personal subjective judgment and objective reading performance and no consistency in type preference from child to child.

> The results with children indicate that although size is the most significant factor at or near the threshold of vision, once above that lower limit, weight becomes the most important factor (Shaw, 1969, p. 60).

An unexpected result was the finding that variations tested apparently made so little difference in legibility. Fifteen percent of the total variance in performance of the adult readers was due to difference in typography, and five percent in the case of children.

Sykes (1971) sought a more objective determination as to whether standard print is, in general, equally or more effective than large print in determining reading ability. Forty-one visually impaired students ages 13 years 3 months to 20 years 11 months enrolled in grades 8-12 at the Michigan School for the Blind, participated in the study. Visual acuities ranged from 20/60 to 20/900. Two forms of a reading test were administered in standard print (10 point type) and in 18 point type. Each student took the test twice, once in standard print and once in large print. The subjects read silently and gave their answers orally. Measures obtained were: reading speed, reading distance, and a measure of fatigue--a five-minute count of involuntary eye-blink rate taken after twenty minutes of reading. The subject was also asked which print size he preferred.

Because of difficulties in recording eye-blink data the scores of thirteen of the 34 subjects used in the analysis of variance were estimated at the means of their groups. There were no significant differences between performances in the two print sizes on measures

of comprehension and reading speed. Therefore, Sykes concluded that standard print, while no better, was as effective as large print in facilitating speed of reading and comprehension. Legally blind subjects showed no difference in fatigue between standard print and large print. Partially sighted subjects who were not legally blind showed less fatigue when reading large print as compared to standard print. The subjective choice of preferred print size was of no relationship to performance in use of the size chosen.

Errors in Oral Reading

Three recent studies have examined the oral reading error patterns of normally sighted students at grade levels ranging from first grade through junior high school. Weber (1970) categorized the reading errors of 21 first grade students into substitutions, omissions, insertions, and scrambles or reversals. Substitutions comprised 80 percent of the total errors made. In a survey of the literature, Weber (1968) found that research agreed that substitution of a different word for the stimulus word consistently outnumbers other kinds of errors at all ages. Using 69 subjects in grades 4, 5, and 6, Christenson (1969) examined the oral reading errors of intermediate grade children at their independent, instructional, and frustration reading levels. His classifications of errors were: omission, substitution,

addition, refusal, repetition, reversal, and gross mispronunciation. Both omissions and additions included parts of words as well as whole words. In the present study only whole words are included in those two categories. He found that repetition errors were more frequent at the independent reading level, whereas mispronunciation, refusal and substitution errors were most frequent at the frustration reading level. The errors in oral reading of poor readers in junior high school were classified by Mullen (1971). The percentages of errors were: assists (words pronounced by the examiner in the present study), five percent; omissions, 12 percent; insertions, seven percent; mispronunciations (substitution and mispronunciation in the present study), 41 percent; hesitations, 12 percent; and regressions, 25 percent.

Bateman (1963) examined the reading of partially sighted children including their reading errors. Four individual reading tests were administered to 39 fourth grade students, 40 third grade students, and 17 second grade students, all partially sighted. These tests were administered in standard editions with strict adherence to the standard time limits. (The general practice is to allow time-and-a-half for partially sighted students on achievement tests.) Reading errors were classified: vowel, consonant, reversal, addition

of sound, omission of sound, substitution, repetition, addition of word, omission of word, or word refused or aided per 500 words read. These proportionate error scores were then converted to a standard score according to the overall average reading grade. The mean standard scores for each type of error were: faulty vowels +1.11, faulty consonants +.50, reversals -.01, addition of sounds +.29, omission of sounds +.89, substitution of words +.19, repetitions -.63, addition of words -.81, omission of words +.12, words aided or refused +.89, and total errors +.98. In relation to the standardization group the partially sighted students made more vowel, consonant, sound omission, words aided and refused, and total errors, while they made fewer errors in addition of words and repetitions and did not differ in number of reversals, additions of sounds, substitutions of words, or omissions of words. The partially sighted group made more vowel errors than any other type error--this being the only error type for which the group mean standard score exceeded $\pm$ 1.0.

Rate and Accuracy for Partially Sighted

Bateman (1963) administered an enlarged form (size unspecified) of the Gates Survey Speed and Accuracy Test to 34 fourth grade students and 12 third grade students. These students' scores were compared to the norms developed on the standardization group of normally sighted

students using the standard edition. The average reading speed of the third grade partially sighted students was 2.2 months below the normally sighted standardization group, and for fourth grade partially sighted students the reading speed was 6.2 months below the standardization group. The partially sighted students using the enlarged form received higher accuracy scores than average.

Place of the Present Study

Studies of print size with normally sighted persons indicate that large typographical differences may be required to produce measurable differences in legibility and that children appear to be less affected by change in type size than adults. Among normally sighted persons the optimum size type for children is apparently somewhat larger than that for adults. Short periods of time are adequate to demonstrate effects of typographical factors on speed of reading. No satisfactory method of measuring visual fatigue has been developed. The present study will use two widely different sizes of type with leading and line width increased in proportion to the increase in type size, and type style held constant. The test instrument requires 30-40 minutes for administration. No measure of fatigue is included.

An historical review of the research on type size with partially sighted students indicates that once the sizes of type tested were brought down into the range of

sizes currently in common use, no one size has been shown to be significantly better than any other specific size for partially sighted students as a group. The Stanwix House study did find 24 point print significantly better. However, it used an artificial restraint of requiring that the reading distance be 14 inches. Current practice allows students to hold materials at any distance thereby increasing downward the sizes of print they can read. In fact, Shaw, who allowed reading at any distance, found that virtually all the children in her study could read 12 point type. The Shaw study which included a diagnostic feature of determining the sizes of type individually found size to be the most important typographical factor tested. The size was not one specific size as compared to other specific sizes, but rather sizes near the smallest size an individual could read. All the studies reviewed for normally sighted adults and children and partially sighted seem to indicate that within a range of visual capability of the person, size does not have much effect. The present study compares the effect of type size on the reading performance of partially sighted students to the effect of type size on the reading performance of normally sighted students. From the studies reviewed, it is expected that regular print will be as effective as large print for both groups of students.

Studies of oral reading error patterns of normally sighted students at a variety of grade levels show that the most frequent error is substitution, which includes substitution and mispronunciation in the present study. Using a different classification of errors Bateman compared the oral reading errors of partially sighted children to the norms for the reading test and found partially sighted students made more vowel errors. They also made slightly more sound omission, words aided and refused and total errors, and fewer errors in addition of words and repetitions. The present study analyzes reading errors of third and fourth grade students in the categories of substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, and omissions. The analyses to be described herein gives the number of errors per thousand words read for each error type and total errors, for each group using regular print and large print, and percentages of each error type. Pearson product moment correlations and t tests are calculated for each error type in regular print to the same error type in large print for both partially sighted and normally sighted groups. In addition, a t test is calculated on the large print score minus the regular print score for each error type for partially sighted versus normally sighted.

Bateman administered a speed and accuracy test in enlarged form to partially sighted students and found the average reading speed of third graders 2.2 months below the normally sighted standardization group and fourth graders, 6.2 months below the standardization group. The partially sighted students using the enlarged form received higher accuracy scores than average. In the present study both normally sighted and partially sighted students are tested using regular print and large print editions of a reading test. Reading rate and accuracy along with comprehension and eight specific kinds of errors are recorded. It is anticipated that the effects of print size will be similar for both groups of students.

The studies reviewed have investigated the effect of print size on normally sighted persons or the effect on partially sighted persons. Bateman compared the reading of partially sighted students using only one print size for each factor to the norms established on normally sighted students. The present study compares the effect of change in print size on partially sighted students to the effect of this same change on normally sighted students. Regular print and large print tests will be administered to normally sighted as well as partially sighted third and fourth grade students. In addition, the present investigation will measure the effect of print size on a wider range of factors (12 in all) than any of the previous studies.

CHAPTER III

PROCEDURE

This chapter will examine the procedure of the present study. The method of obtaining the sample will be described along with a listing of the characteristics of the subjects. The choice of the test used as the instrument will be elaborated upon. The procedures followed in the testing situation and in the calculation of scores will be given along with the hypotheses and statistical tests used.

An examination of the effect of print size on the reading performance of normally sighted and partially sighted third and fourth grade students was the purpose of this investigation. Subjects were given reading materials in both regular print and large print and their performance with the two print sizes was compared.

Sample

The sample consisted of 23 normally sighted and 23 partially sighted third and fourth grade students enrolled in public schools of Massachusetts. The partially sighted subjects were all the third and

partially sighted students. Only a portion of the students whose vision is better than this definition were included in the group designated as normally sighted. In order to have two discrete groups, normally sighted subjects were defined as having a visual acuity of 20/50 or better in the poorer eye with correction. Within the range under consideration visual acuities are recorded as 20/50, 20/60, and 20/70. Students with 20/60 acuity were excluded from both groups. In addition the partially sighted were defined in terms of the better eye and the normally sighted in terms of the poorer eye, so that there was no overlap between the two groups.

The 23 normally sighted subjects were chosen at random from the students of the same grade level in the same regular classroom in which the visually handicapped student was enrolled, one for each partially sighted subject. Students receiving special education services were not included. The Snellen Test Chart (National Society for the Prevention of Blindness) administered by the examiner was used as a screening instrument for all the normally sighted subjects. Only students with a visual acuity of 20/50 or better in the poorer eye with correction were used as subjects in the present study.

The characteristics of the subjects are given in Table 1 and Table 2.

The visual acuity of the partially sighted subjects was obtained through the teacher of the visually handicapped from the school's eye reports. The most recent eye report on each subject was used with the exception of partially sighted subject #20. In the case of this student the two available eye reports were examined in an effort to get a specific visual acuity. The most recent report listed "limited vision" and "minimal vision" for the right eye and no vision in the left eye. The report from October 1967 listed the right eye as hand movement at one foot and the left eye as counts fingers at 18 inches. The examination of the two records led to the determination that this subject was legally blind. In most cases the eye specialist reported the visual acuity of the right eye and left eye separately or of both eyes together rather than giving both measures.

Eleven of the partially sighted and eleven of the normally sighted subjects were third grade students. The remaining 12 in each group were fourth grade students. As determined by casual observation of the examiner, three normally sighted and two partially sighted subjects were Negroes. The remainder were

Table 1: Characteristics of Normally Sighted Subjects

Subject	Grade	Age	Sex	Race	Visual Acuity OD (right)	Visual Acuity OS (left)
N 1	4	10-2	F	C	20/30	20/30
N 2	4	11-0	F	C	20/20	20/20
N 3	3	8-10	F	C	20/30	20/30
N 4	3	9-2	M	C	20/30	20/30
N 5	3	8-8	M	C	20/20	20/30
N 6	4	9-9	M	C	20/30	20/30
N 7	4	9-10	M	N	20/20	20/30
N 8	4	9-6	F	C	20/40	20/40
N 9	4	9-2	M	C	20/30	20/20
N10	3	8-3	F	C	20/50	20/30
N11	3	8-4	M	C	20/20	20/20
N12	4	10-3	F	C	20/30	20/40
N13	3	9-0	F	C	20/30	20/40
N14	4	9-8	M	C	20/20	20/20
N15	4	10-11	F	N	20/30	20/20
N16	3	9-3	M	C	20/20	20/30
N17	4	9-9	F	C	20/30	20/20
N18	3	9-3	M	C	20/30	20/40
N19	4	9-10	F	C	20/20	20/30
N20	4	9-10	F	C	20/20	20/30
N21	3	8-3	M	N	20/30	20/40
N22	3	9-2	F	C	20/20	20/20
N23	3	8-9	M	C	20/30	20/20

Table 2: Characteristics of Partially Sighted Subjects

Subject	Grade	Age	Sex	Race	Visual Acuity* OD (right)	OS (left)	OU (both)	Legally Blind
P 1	4	10-3	F	C	20/70-1	20/70-1		No
P 2	4	9-6	F	C	20/200	20/200		Yes
P 3	3	9-8	M	C			20/200	Yes
P 4	3	8-5	F	C	10/200	20/200		Yes
P 5	3	9-6	M	C	20/300	20/200		Yes
P 6	4	10-0	M	C	12/200	12/200		Yes
P 7	4	9-9	M	C			20/300	Yes
P 8	4	9-7	F	C	20/70	20/70		No
P 9	4	11-10	M	C			20/100	No
P10	3	9-0	M	C	10/400	20/400		Yes
P11	3	8-5	F	C	20/400	20/300		Yes
P12	4	11-6	F	C	20/100	20/100		No
P13	3	9-5	F	C	20/100	20/100		No
P14	4	10-4	M	C	20/70	20/70		No
P15	4	9-10	F	C	20/70	20/200		No
P16	3	9-7	F	C	20/200	20/300		Yes
P17	4	9-10	M	C	20/200	20/200	20/200	Yes
P18	3	8-10	M	C	20/70	20/70		No
P19	4	10-3	F	C	20/300	20/300	20/300	Yes
P20	4	10-7	M	C	limited vision	nil		Yes
P21	3	9-4	M	N			20/200	Yes
P22	3	9-8	M	N			20/200	Yes
P23	3	9-0	M	C			20/200	Yes

*The visual acuity was taken from school eye reports on the student. Typically the eye specialist reported either the visual acuity of the left eye and right eye separately or the acuity of the two eyes together, rather than giving both readings.

Caucasian. Among the normally sighted subjects, 11 were male and 12 were female. The partially sighted subjects included 13 males and 10 females. Within the group of partially sighted subjects, 15 students were legally blind and eight had vision better than legal blindness. No record was made as to whether the partially sighted students had used large print in the past or present. Nor was any record of preference for print size made.

Instrument

This section will discuss the instrument used in the present study starting with the bases on which the instrument was chosen. The description of the test and its construction, procedures for establishing validity, reliability and equivalence of the two forms, and reviews of the test. The adaptation of the test for use in this investigation will be described and the influence of the instrument chosen on the choice of subjects will be discussed.

An oral reading task was chosen so that a record could be made of different types of errors. These records provided the data on patterns of errors under the various conditions of partial vision and normal vision and regular print and large print. A standardized

test was used to provide a structured unit of practically workable size and a basis for comparison of scores.

As was pointed out in Chapter I, teachers of partially sighted students do not currently have a diagnostic tool to use in determining what print size a partially sighted student might best use. Previous research (Birch, 1966) has indicated that no one size of print is best for all or even a majority of partially sighted students. In addition, in the case of an individual student, one print size was not clearly better than another. The Birch study indicates that there is no one best answer to the question of what print size to use, but it does not provide the teacher of the partially sighted with guidelines for determining whether large print or regular print should be used by an individual partially sighted student.

The present study was planned with the hope of developing a procedure which might offer guidance to a teacher of partially sighted students for choosing a print size. The experimenter was interested in developing a procedure and evaluating its usefulness experimentally which could be used by the classroom teacher. Concern for a practical time allotment led to consideration of using only two sizes of type, one a regular

print and one a large print. The Birch study which used a continuum of print sizes, 12, 15, 18, 21, and 24 point did not establish one superior print size. The present study used only two print sizes to provide discrete measures and to allow for a larger difference between variables.

Print size is measured in points with the larger size print having the higher number of points. Eighteen point print is commonly used in the production of large print materials. Birch reports his findings relative to 18 point type.

> Approximately four of ten (43.3 percent) partially seeing children seem to need rather large type (21 and 24 point) in order to read most effectively. Another four out of ten (41.0 percent) can read much smaller type sizes (12 and 15 point) best. Neither of the two groups (eight of ten or 84.4 percent) is best suited by 18 point type (Birch, 1966, p. 71).

An examination of these results led to the conclusion that print either larger or smaller than 18 point would be more useful than 18 point. The smaller type sizes, 12 and 15 point, exhibit very little difference from regular print, therefore the decision was to use a print larger than 18 point. Both 21 point and 24 point type are quite large. Although 21 point print is not commonly used with partially sighted students, it was chosen as the size for the present study because it was the smaller of the two very large sizes and therefore less bulky and unmanageable. It would also be a little

closer to the size of print most commonly available.

The use of two print sizes necessitated finding an instrument which could provide measures on two equivalent forms of a reading test. The Gilmore Oral Reading Test provided such an instrument using the oral reading task. The test includes Form A and Form B.

The Gilmore Oral Reading Test was developed to provide a means of analyzing the oral reading performance of pupils in grade one through eight. Each form of the test is comprised of 10 paragraphs of increasing difficulty which form a continuous story. Forms A and B each relate a different story. Three variables were considered in gradation of paragraphs. The vocabulary was graded by an increase in the number of words, use of words or appropriate and evenly increasing difficulty and through controlled use of polysyllabic words. Sentence structure considered length of sentence and percent of complex sentences. Materials were planned within the experience and interest of pupils at the various grade levels.

Comprehension was determined by five recall-type questions for each paragraph. Gilmore states further

> Since the material was carefully graded with respect to vocabulary difficulty, grammatical construction, and subject matter, it was assumed that comprehension of the paragraphs would thereby become more difficult and that the questions would thus differentiate readers of varying degrees of comprehension skill (Gilmore, 1952, p. 3).

Validity was obtained from comparison of scores made by 24 fifth grade pupils on the Gilmore Oral Reading Test, Form A with Gray's Oral Reading Paragraphs and Durrell Analysis of Reading Difficulty. The Pearson product-moment correlations were: Gilmore-Gray, accuracy .77, rate .45; Gilmore-Durrell, accuracy .80, comprehension .59, and rate .50; and Gray-Durrell, accuracy .73, and rate .39. In reviewing the test, Duggins (1959) states, "The reviewer is of the opinion that the face validity of the test is so obvious that the scanty statistical evidence of validity should not be a deterent to its use" (p. 62).

Another review is found in CSE Elementary School Test Evaluations (Hoepfner, 1970) which evaluates a variety of tests used in elementary schools. Tests for grades 1, 3, 5, and 6 are reported. The Gilmore Oral Reading Test is listed under Reading Mechanics (Oral Reading) for first and third grade. The ratings of the Gilmore test are identical for both grade listings. The Gilmore Oral Reading Test was rated the highest in measurement validities of the tests of oral reading in the third grade ratings, being the only test assigned a "good" rating. On normed technical excellence the Gilmore test was rated "poor" along with all other tests rated except the Wide Range Achievement Test, which received a "good" rating. The WRAT does not include reading

in context, a feature which was desired for use in the present study.

Alternate forms correlations for groups of second, fifth and seventh grade students indicate high reliability for accuracy (.89, .85, and .84) and lower reliability for comprehension (.68, .67, and .52) and rate (.95, .72, and .59) particularly for students at higher grade levels. The Kuder-Richardson reliability coefficients for accuracy and comprehension for grades two, five, and seven show the same trends: accuracy, .88, .86, .89 and comprehension, .82, .78, and .78. The present study tests third and fourth grade students.

To establish the equivalence of the two forms of the test, Forms A and B of the Gilmore Oral Reading Test were administered alternately within each grade, and the distribution of Metropolitan Paragraph Meaning standard scores compared for the pupils taking each form. The means and standard deviations of the two groups were almost identical at all grade levels. For all grades combined the means and standard deviations were: Form A, 178.73 and 40.05; Form B, 178.02 and 40.55.

In order to keep the various factors of print, other than size, consistant for the two forms of the test the method of producing the test in large print was

to photograph the regular print edition and enlarge it to the prescribed size. An additional factor in favor of this method of reproduction was its easy availability to the teacher of partially sighted students. Should a teacher of the visually handicapped need a test in large print, the most readily available method of producing it would be this method.

The regular edition of the Gilmore Oral Reading Test is printed in a variety of sizes corresponding to the changes in print sizes of reading materials provided for students at the grade levels of difficulty of each paragraph. When this material was photographed and enlarged the same gradation in sizes was present in the large print edition, only larger in each case. As a result the regular print edition included some print sizes which could be classified as large print, and neither form had an absolute size throughout the test. However, at each difficulty level the large print edition was larger than the regular print edition. This was justified because the regular print edition was indicative of the size print which would ordinarily be provided in regular print for a student reading at the difficulty level in each paragraph. A student who needed enlarged print at any point within the test could be theorized to need a correspondingly larger print.

The large print edition was reproduced so that the smallest print in the reading paragraphs was 21 point type. The largest print in the test, the first through third grade paragraphs, is approximately 24 points. This range of print sizes placed the large print edition of the test within the two print sizes which Birch (1966) found 43.4 percent of the children in his study needed. Figures 1 and 2 give samples of the print sizes of regular print and large print editions of reading paragraphs at the first, fourth, and tenth grade levels.

A range of two grade levels for subjects was chosen in order to obtain an adequately large number of subjects within a reasonable geographic area. Third and fourth grade students were chosen because this is the point in the school experience when the size of the print in textbooks is commonly reduced. As a result students who have not previously needed enlarged materials may need them for the first time. In addition students who had not been identified as partially sighted first come to the attention of school authorities as partially sighted students, in part because of the reduction in print size. In a previous study using the Gilmore Oral Reading Test (Mullen, 1970), three of 29 students in an inner-city regular fourth grade classroom, tested at the beginning of the school year, scored at the seventh grade level of the Gilmore test. Since the present study included

Figure 1: Samples of Print Sizes in the Regular Print Edition

They play on the floor.
The man is in the big chair.
He is looking at the two boys.
Mother is sitting in a chair, too.

Size of Print in Paragraphs 1-3

picnic ground on the hill, and the valley below has a pretty little pond. The girls always enjoy watching the boys while they sail their tiny boats in the water. Mother and Father enjoy picnics

Size of Print in Paragraphs 4-9

normally encouraged in secondary school through the department of social studies. The college curriculum provides opportunities for the extension and deepening of this interest by giving students a historical perspective:

Size of Print in Paragraph 10

Figure 2: Samples of Print Sizes in the Large Print Edition

They play on the floor.
The man is in the big
He is looking at the tw

Size of Print in Paragraphs 1-3

le pond. The girls always enjoy
boys while they sail their tiny boats
Mother and Father enjoy picnics

Size of Print in Paragraphs 4-9

encouraged in secondary school
nt of social studies. The colleg
opportunities for the extension and
rest by giving students a historical

Size of Print in Paragraph 10

students from a wide range of socio-economic areas tested later in the school year, this test was judged not to be difficult enough to use for differentiated scores with students at a higher grade level.

Procedures

The tests were administered in each subject's school. The location used for the testing was whatever was provided by the school. It varied from school to school. Among the locations provided were classrooms, offices, libraries, halls, auditoriums and gymnasiums. In each case the location provided a table or desk for the subject, adequate lighting, and relative quiet and freedom from interruptions. Often the location was that assigned to the teacher of the visually handicapped for instruction of the partially sighted student. In all but one school the normally sighted and partially sighted subjects were tested in the same location, so that each had an approximately equally suitable location. In three cases the partially sighted subject was tested in the morning and the normally sighted subject was tested in the afternoon. In all other cases the normally sighted subject and the partially sighted subject were both tested in the morning or both in the afternoon.

Administration of the Snellen Test Chart was a standard part of the testing situation for all normally

sighted subjects. The Snellen Test was given in the same room in which the reading test was administrated in locations in which this room provided both good light for the chart and a 20 foot distance in which to test. When the testing room did not provide these conditions another location was found in the school which did provide them.

In Massachusetts schools it is the policy to record pass or fail on the Massachusetts Vision Test on the child's school records, rather than to record a specific visual acuity. Using the Snellen Test Chart allowed the examiner to get a visual acuity reading on the normally sighted subjects. The Snellen Test Chart is a screening instrument when it is used by a lay person. Such testing is not recognized as being as accurate as that administered by an eye specialist. In addition, assessing the visual acuity of a legally blind child requires far greater sophistication than a lay person using a Snellen Test Chart. Fifteen of the partially sighted subjects were legally blind. Since admission to a program for the visually handicapped requires a report from an eye specialist which includes a visual acuity, these school records were used to obtain the visual acuity for the partially sighted subjects.

The tests were administered to each subject individually with both forms of the test given in one sitting.

Each subject received Form A in regular print and Form B in large print. One test was given in its entirity before the second test was administered. The order of administration of the two forms was changed at random with the two subjects from the same regular classroom receiving the same order.

Subjects were allowed to use any glasses or reading aids which they brought with them to the testing. They were not instructed to use any aids. It was assumed that they would come with any aid ordinarily used for reading when they were informed that they were to perform a reading task. One subject, partially sighted subject #19, used reading glasses to read the regular print test and her regular glasses to read the large print editions. No other subjects used reading aids.

In instructional or independent reading settings a student is allowed to hold the reading materials at whatever distance from the eyes he chooses. This means that he can change the distance as the print size or other factors change, to provide the optimum conditions for all materials. In order to duplicate realistic reading conditions subjects were allowed to hold the test materials at any distance from the eyes they chose. No instructions were given to the subjects about holding the materials or reading distance. They were allowed to use the positions they naturally chose. The distances

the subjects held the materials from the eyes varied from paragraph to paragraph for some subjects, as well as differing from subject to subject. No record was kept of the distances each subject held the materials from the eyes.

In order to allow subjects to become accustomed to large print, a practice story was given in large print before the large print edition of the test was administered. A similar practice story was given in regular print before the regular print edition of Form A, so that the format of the two tests would be the same. Two stories were chosen from the 3^1 level of a reading test as the practice exercises. The standard edition was used with Form A and an enlarged copy produced by the same process as the large print edition of the Gilmore test was used with Form B. The examiner recorded the subject's errors during the reading of the practice exercise as was done in the actual test. Five comprehension questions were asked following the reading of the practice story and checked as in the test situation.

The subjects were told, "I am going to give you two sets of stories to read. Before each set of stories is a practice story. Here is the practice story for the first set. I want you to read this story out loud and I will ask you some questions about it when you finish."

After the practice exercise and before each form of the test was administered, the subject was shown the picture which accompanies each form of the standard edition of the test. The pictures are black and white line drawings of the characters in each form of the test. Paragraphs one and two are about the pictures. Paragraph three gives information which goes along with the picture, but which does not specifically relate to the action in the picture. The other paragraphs are unrelated to the picture. The pictures from the standard edition of the Gilmore Oral Reading Test were used for both the regular print and large print editions of the test. The picture is one drawing covering the entire page of the test booklet. The process by which the test was enlarged usually produces pictures of inferior quality. The pictures are often indistinct with the black in the picture being gray in the enlarged copy. This was true of the enlarged edition of the Gilmore Oral Reading Test. In addition the experimenter judged the picture, covering an entire page, to be sufficiently large for the partially sighted subjects, and the pictures in the large print edition to be too large for them. The student was presented the picture and told, "Here is a picture of the family in the first set of stories. You will notice that there is a mother and a father, a boy

and a girl, and a dog and a cat. Can you tell me something about what is happening in the picture?"

The student's story or description of detail was accepted in whatever form or length it was given. If the student asked a question about the picture, it was answered. If the student gave incorrect information about the picuure, the misinformation was corrected. When the student finished his description, the picture was removed from sight.

The Manual of Directions for the Gilmore Oral Reading Test (Gilmore, 1952, p. 7) directs the examiner to have a pupil start the test with that paragraph which is two paragraphs below the pupil's present grade level, unless the examiner knows that the pupil is a much poorer reader than the typical pupil for his grade. The teachers were not asked any questions about the students' reading levels, so that the examiner had no prior information on which to determine the starting level. However, the pupil's performance in the reading of the practice story provided some information on which to determine the starting level. The examiner made a clinical decision in determining the starting level, based on the directions in the manual and the pupil's performance on the practice story. When the second form of the test was started, this clinical decision included information from the student's performance on the first form of the test.

The examiner turned the test book to the page with the paragraph of the appropriate difficulty level and handed it to the pupil saying, "Now read this paragraph and answer some questions when you finish."

When the paragraph was finished the test book was taken from the pupil and placed on the table face down. Then the five comprehension questions for the paragraph were asked and the answers recorded.

The Manual of Directions gives the following instructions for establishing a basal level and ceiling level once the starting level has been determined.

> If the pupil makes more than two errors on this paragraph, drop back one paragraph; if he makes two or less errors, continue to the next higher paragraph. The examiner should go back one paragraph at a time until the point is reached at which the pupil makes no more than two errors on a paragraph. This is his basal level.... The examiner continues presenting the paragraphs in numerical order, omitting any that were read while establishing the basal, until the pupil reaches the paragraph on which he makes ten or more errors. This is his 'ceiling' level, and is the last paragraph to be read by the pupil (Gilmore, 1952, p. 7-8).

As the pupil read each paragraph the examiner recorded his errors on the pupil's Record Blank shown in the Appendix. The types of errors which were recorded are listed with the descriptive definition given by Gilmore (1952). "Substitutions--a sensible or real word substituted for the word in the paragraph" (p. 8). A substitution was marked by writing the word the pupil said over the word in the paragraph. "Mispronunciations--

A nonsense word which may be produced by (1) false accentuation; (2) wrong pronunciation of vowels or consonants; or (3) omission, addition, or insertion of one or more letters" (p. 8). A mispronunciation was marked by drawing a line through the mispronounced word. "Words pronounced by examiner--A word on which subject hesitates for 5 seconds" (p. 8). Two checks were made above the word pronounced by the examiner. "Disregard of punctuation--Failure to observe punctuation" (p. 9). An X was written above disregarded punctuation. "Insertions (including additions)--A word (or words) inserted at the beginning, in the middle, or at the end of a sentence or line of text" (p. 9). A caret mark was made at the place in which the insertion was made, with the word or words added written above. "Hesitations--A pause of at least two seconds before pronouncing a word" (p. 9). One check was made above the word on which the hesitation occured. "Repetitions--A word, part of a word, or group of words repeated" (p. 9). A line was drawn under the repeated word or words. "Omissions--One or more words omitted" (p. 9). A circle was drawn around omitted words.

The Manual of Directions gives these additional guidelines for counting errors.

> If the subject hesitates on a word for 2 seconds, a check mark is placed above the word to indicate a hesitation. If the word is

> pronounced by the examiner, a second check mark is made above the word. This counts as one error--a 'Words pronounced by Examiner' error.
>
> If a pupil hesitates and then makes a mispronunciation or substitution error, this is counted only as a mispronunciation (or substitution) error.
>
> Even if a pupil repeats a word, part of a word, or group of words several times, this is considered as only one error. If a pupil makes a mispronunciation or substitution error and then corrects himself immediately, do not count as a repetition error, but only as a mispronunciation (or substitution) error (Gilmore, 1952, pp. 8-9).

Two errors were found which did not clearly meet the descriptions given by the author of the test. An inversion of two words was counted as one omission and one insertion. A word read syllable by syllable was marked as a hesitation. Each error was counted in one classification only.

The scoring of the test followed the standard directions given in the Manual of Directions. These directions provided the following scores: accuracy, raw score and grade level; comprehension, raw score and grade level and rate in words per minute.

The highest grade level score assigned for accuracy and comprehension is 9.8+. In order to perform the various calculations required, it was necessary to change this score to a specific numerical designation. Because it was not possible to determine the amount to which each 9.8+ score surpassed the next highest score of 9.8, each 9.8+ score was given the next step in grade level

of 9.9 for the purposes of calculation.

A stop watch held inconspicuously was used to time each paragraph in seconds. The reading rate was calculated according to the instructions given in the Manual of Directions. The method of calculating the rate deviated for two subjects. The time was not recorded on one paragraph in Form B for partially sighted subject #16. Therefore her rate score was interpolated from the two paragraphs for which the time was recorded. She was included among the subjects even with this error in test administration because the reading rate is only a small part of the total information gathered and independent of the other score calculations. Normally sighted subject #21 made multiple omissions of groups of words in paragraph 5 in Form B with a total of 17 words omitted. Therefore 17 words were subtracted from the number of words read in paragraph 5 for the calculation of his rate score. In other instances where only a few words were omitted, the standard number of words read were used in the calculation of words per minute.

In addition to these regularly calculated scores the total of each type of error, and the total number of errors was tabulated. For the purposes of this tabulation errors were counted from all paragraphs read except the ceiling paragraph and those below the adjusted basal level. Excluding the ceiling paragraph parallels

the instructions for calculating the rate, in which the ceiling paragraph is omitted from the count of number of words read and seconds of reading time. The adjusted basal level and the exclusion of paragraphs below that level are explained in the following paragraphs.

Because a clinical decision described earlier was used to determine the starting point of the test, in a number of instances the starting point in the test was too low, so that the subject read several paragraphs before he read up to a basal level. If the examiner had started above this point and came down to his basal level, the lower paragraphs would not have been read. This resulted in one or more paragraphs which could be called too easy for the subject. In order to get the ratio of number of errors to number of words read, from the same difficulty range for all students these paragraphs which were too easy were eliminated from the count of errors. Elimination of these paragraphs kept those subjects from having an unrealistically low ratio of errors to words read.

The adjusted basal level was identified as the highest level at which no lower paragraph contained more than two errors. As a result of using this adjusted basal level 36 paragraphs containing 31 errors were eliminated from the tests of 22 subjects. This adjusted

basal level was used only in the calculations involving numbers and types of errors. It was not used in any of the scores for which scoring directions were given in the Manual of Directions.

The number of words read varied from subject to subject resulting in units lacking a common basis for comparison. For calculation purposes the errors were recorded as a ratio of errors to number of words read. The figure was given in number of errors per thousand words read. This ratio was calculated for each error type and for the total number of errors for each form of the test on each subject.

Hypotheses

Six hypotheses examined a total of 64 questions about the effect of print size on the reading performance of normally sighted and partially sighted third and fourth grade students. The hypotheses are as follows:

Hypothesis 1: For partially sighted subjects reading performance scores on the regular print test relate positively to the same reading performance scores on the large print test.

Hypothesis 2: There is no difference in the reading performance of partially sighted subjects on the regular print test and the large print test.

Hypothesis 3: For normally sighted subjects reading performance scores on the regular print test relate positively to the same reading performance scores on the large print test.

Hypothesis 4: There is no difference in the reading performance of normally sighted subjects on the regular print test and the large print test.

Hypothesis 5: There is no difference in the differences in reading performance of normally sighted and partially sighted subjects. The difference score is defined as the score on the large print test minus the score on the regular print test.

For each of these hypotheses reading performance is defined as the score received on each of twelve factors measured: accuracy, comprehension, rate, substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, omissions and total errors.

Hypothesis 6: The proportions of normally sighted subjects distributed into groups according to size and direction of difference between reading scores (regular print < large print, regular print = large print, regular print > large print) is not different from those for partially sighted subjects. This hypothesis was tested on the four major factors: accuracy, comprehension, rate and total errors.

Statistical Procedures

The statistical procedures used in the present study are Pearson product moment correlation, t-test, repeated measures t-test, and chi square proportion analysis.

The Pearson product moment correlation is used in the present study as a descriptor of the groups of subjects rather than as a predictive statistic for making applications beyond this sample. Hays (1963) states that when correlation is used as a descriptive statistic it is not necessary to make any assumptions about the form of the distribution, the variability of Y scores with X columns, or the true level of measurement represented by the scores. Based on this statement the necessity for meeting the usual assumptions underlying Pearson product moment correlations were not felt to be required in the present study.

The two assumptions underlying the t-test are: a normal distribution in the population and equal population variances. Hays (1963) states that departure from normality makes less difference in a two-tailed, than in a one-tailed result. He further states, "By and large, however, this assumption of normal distribution in the populations may be violated almost with impunity provided sample size is not extremely small" (Hays, 1963, p. 322).

Regarding homogeneity of population he recommends that when there is doubt of the homogeneity of population variances samples of the same size be used. The present study incorporates these safeguards. Two-tailed t-tests are used. The sample size of 23 in each group is not extremely small. Samples are the same size.

In addition the use of the t-test requires that the observations be independent. In the case of the comparison of the partially sighted subjects with normally sighted subjects this is followed. The two t-tests which compare the same scores on the two forms of the reading test are not independent as they involve scores on repeated measures. For these two tests a repeated measures t-test is used which takes into account this necessary dependence in the observations.

As a nonparametric technique the X^2 test does not assume that the scores were drawn from a population distributed in a certain way; it may be used with scores in nominal or ordinal scales as well as interval or ratio scales; and it can be used with small numbers. In the present investigation we are interested in finding out if the proportion of the two samples differ in any respect while using an ordinal scale for classifying the groups. Siegel's (1956) discussion of the use of the X^2 test as compared to other tests for two independent samples indicates that the X^2 test is among those

recommended for use to determine if the two samples are from populations which differ in any respect, i.e., in location, or dispersion, or skewness, etc. The X^2 test is suitable for data which are in nominal or stronger scales. A caution on interpretation of results of this test is given. If one rejects H_o on the basis of the X^2 test "one can then assert that the two groups are from different populations but one cannot say in what specific ways the populations differ" (Siegel, 1956, p. 158). Certain requirements for expected frequencies are placed on the X^2 test. These requirements and their application to the specific data from the present study will be discussed in Chapter IV.

Summary

Twenty-three normally sighted and 23 partially sighted third and fourth grade students were subjects. Each subject was administered the Gilmore Oral Reading Test, Form A, in the regular print edition and Form B in a large print edition. The following scores were calculated of each form of the reading test: accuracy grade level, comprehension grade level, rate in words per minute and ratio of errors per thousand words read for each of eight types of errors and the total number of errors.

The test instrument chosen for this study, the bases for its selection, and a discussion of the test itself were given. The procedures followed in the experimental setting and in scoring and tabulation of results were discussed. The statistical tests applied to the data were Pearson product moment correlations, t-tests, repeated measures t-tests, and chi square proportion analysis.

CHAPTER IV

RESULTS OF THE STUDY

The purpose of the present study was to determine the effect of print size on the reading performance of normally sighted and partially sighted third and fourth grade students. Twenty-three normally sighted and 23 partially sighted public school students were administered the Gilmore Oral Reading Test in the regular print edition and a large print edition. The means, standard deviations, minimum scores, maximum scores, and ranges for the twelve factors of interest are shown in the Appendix in Tables 14 through 25. The relationship of the accuracy and comprehension scores will be examined along with an analysis of the error patterns. The remainder of the chapter will present and discuss the results in relationship to the hypotheses introduced in Chapter III.

Results of the Investigation

Accuracy and comprehension grade levels were examined for a comparison of these two scores for individuals within each group. A summary of the relationship of these two scores for individuals within each treatment group may be seen in Table 3. An inspection

Table 3: Accuracy and Comprehension Scores Compared Within Each Treatment Group

Group	Acc > Comp	Acc = Comp	Acc < Comp
Regular Print	2	1	20
Partially Sighted			
Large Print	6	1	16
Regular Print	10	2	11
Normally Sighted			
Large Print	16	0	7

of this summary reveals that regardless of the print size used with partially sighted subjects the comprehension score remained the higher of the two for most students. For normally sighted subjects each of the two scores was better for approximately the same number of subjects when using regular print. A noticeably larger group of normally sighted subjects scored higher on accuracy than comprehension when using large print.

Errors in oral reading were tabulated on the basis of total number of errors and by eight categories of errors. These tabulations shown in the Appendix in Table 26 were calculated from the actual number of words read. It was found that 36 percent of the errors are substitutions. The second most common error is repetition, which accounts for 20 percent of the total errors. For the total sample, mispronunciations is the third most common error, with 10 percent of the total errors. An analysis of the error patterns for the total sample and for each treatment group may be seen in Table 4.

If large print is superior to regular print for partially sighted students we would expect partially sighted students to score higher on the large print test than on the regular print test. In addition those who score high on regular print would also be expected to score high on large print--with the large print

Table 4: Percentage of Errors Categorized by Error Type for Each Treatment Group and Total Sample

Error Type	Partially Sighted RP	Partially Sighted LP	Normally Sighted RP	Normally Sighted LP	Total Sample
Substitutions	45%	31%	34%	33%	36%
Mispronunciations	5%	10%	12%	9%	10%
Words Pronounced by the Examiner	6%	4%	4%	3%	5%
Disregard of Punctuation	8%	8%	9%	8%	8%
Insertions	4%	7%	4%	12%	7%
Hesitations	7%	10%	7%	6%	7%
Repetitions	18%	21%	22%	20%	20%
Omissions	6%	7%	7%	7%	7%

scores being the higher of the two. Two hypotheses were proposed to verify this theory.

Hypothesis 1: For partially sighted subjects reading performance scores on the regular print test relate positively to the same reading performance scores on the large print test.

Hypothesis 2: There is no difference in the reading performance of partially sighted subjects on the regular print test and the large print test. A rejection of the hypothesis with a better performance score on the large print test would indicate that partially sighted subjects perform better using large print. A rejection of the hypothesis with a better performance score on the regular print test would indicate that partially sighted subjects perform better on the regular print test.

Pearson product moment correlations were used to test Hypothesis 1 (Table 5). The correlation of accuracy in regular print to accuracy in large print is +.96 ($p < .001$). For comprehension in regular print to comprehension in large print the correlation for partially sighted subjects is +.70 ($< .001$). Scores on both accuracy and comprehension in regular print relate positively to accuracy and comprehension scores in large print for partially sighted subjects. The correlation

Table 5: Pearson Correlation and Probability Values for Each Factor in Regular Print to the Same Factor in Large Print for Partially Sighted Subjects

Reading Factor	Correlation	P-value
Accuracy	+.96	<.001
Comprehension	+.70	<.001
Rate	+.68	<.001
Substitutions	+.75	<.001
Mispronunciations	+.04	n.s.
Words Pronounced by the Examiner	-.15	n.s.
Disregard of Punctuation	+.42	<.02
Insertions	+.37	<.04
Hesitations	+.30	n.s.
Repetitions	+.42	<.02
Omissions	+.22	n.s.
Total Errors	+.60	<.002

of rate in regular print to rate in large print for partially sighted subjects is +.68 ($p < .001$). The same subjects score high on rate in both regular print and large print.

When error scores are the variables of interest, a similar but less pronounced pattern is observed. Positive correlations are found for each of the following error types in regular print to the same factor in large print: substitutions +.75 ($p < .001$), disregard of punctuation +.42 ($p < .02$), insertions +.37 ($p < .04$), repetitions +.42 ($p < .02$), and total errors 1.60 ($p < .002$). Among partially sighted subjects for each of these error types subjects who made many of one type of error in regular print also made many of the same type errors in large print.

However r's for mispronunciations, words pronounced by the examiner, and repetitions for the two print sizes are all of low magnitude. None have a probability of occurence by chance less than .05.

Hypothesis 2 was tested with repeated measures t-tests comparing the regular print score for each factor to the large print score on the same factor for partially sighted subjects (Table 6). The mean grade level of accuracy for partially sighted subjects is 4.265 in regular print and 4.652 in large print ($p < .001$). The

Table 6: Means, Standard Deviations, t-Values, and Probability Values for t-Tests on Regular Print Versus Large Print Scores for Partially Sighted Subjects

Reading Factor	Regular Print Mean	Regular Print SD	Large Print Mean	Large Print SD	t value	p value
Accuracy (grade level)	4.265	1.534	4.652	1.639	-3.95	$<.001$
Comprehension (grade level)	5.483	2.119	5.365	2.242	.33	n.s.
Rate (w.p.m.)	101.48	21.09	93.39	28.54	1.85	n.s.
Substitutions	24.96	17.06	22.96	18.54	.76	n.s.
Mispronunciations	1.56	3.14	4.35	5.87	-2.04	$<.05$
Words Pronounced by the Examiner	1.74	4.01	1.74	3.60	0.0	n.s.
Disregard of Punctuation	3.96	6.06	5.87	7.58	-1.23	n.s.
Insertions	2.52	4.77	5.09	8.48	-1.53	n.s.
Hesitations	5.30	10.53	6.74	8.69	-.60	n.s.
Repetitions	10.17	8.27	12.61	9.01	-1.25	n.s.
Omissions	3.17	4.43	4.91	6.20	-1.23	n.s.
Total Errors	52.48	17.07	65.39	30.96	-2.50	$<.02$

hypothesis is rejected. In this instance the scores are significantly better in large print. However, for partially sighted subjects the mean grade level for comprehension of 5.483 in regular print and 5.365 in large print does not differ markedly. A regular print mean score of 101.48 words per minute for partially sighted subjects is not significantly different from a mean score of 93.39 words per minute in large print.

Only two of the nine error scores show difference with a probability less than .05. The mean ratio of mispronunciations in regular print is 1.56 and in large print 4.35 ($p < .05$). For total errors the mean score in regular print is 52.48 and 65.39 in large print ($p < .02$). Regular print with the lower ratio of mispronunciations and total errors was better for the partially sighted subjects.

The other error score differences are too small to be of significance. These are: substitutions, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, and omissions.

In order to compare the effects of print size on normally sighted students with these effects on partially sighted students the scores for normally sighted subjects were tested by the same hypotheses.

Hypothesis 3: For normally sighted subjects reading performance scores on the regular print test relate positively to the same reading performance scores on the large print test. This hypothesis was tested by calculating Pearson correlations for each factor of reading performance measured on the regular print test to the same factor on the large print test for normally sighted subjects (Table 7).

Hypothesis 4: There is no difference in the reading performance of normally sighted subjects on the regular print test and the large print test.

The correlation of accuracy grade level scores in regular print to accuracy scores in large print for normally sighted subjects is +.82 ($p < .001$). Comprehension grade level scores in regular print correlate with comprehension scores in large print +.54 ($p < .005$). Normally sighted subjects who score high on accuracy and comprehension in regular print also score high on accuracy and comprehension in large print. For normally sighted subjects the rate in words per minute in regular print correlates +.54 with rate in large print ($p < .03$). Normally sighted subjects with the higher rate of reading in regular print are also the ones with the higher rate of reading in large print.

Table 7: Pearson Correlation and Probability Values for Each Factor in Regular Print to the Same Factor in Large Print for Normally Sighted Subjects

Reading Factor	Correlation	P-value
Accuracy	+.86	$<.001$
Comprehension	+.54	$<.005$
Rate	+.39	$<.03$
Substitutions	+.52	$<.006$
Mispronunciations	+.34	$<.05$
Words Pronounced by the Examiner	+.71	$<.001$
Disregard of Punctuation	-.02	n.s.
Insertions	+.02	n.s.
Hesitations	-.05	n.s.
Repetitions	+.53	$<.005$
Omissions	+.12	n.s.
Total Errors	+.55	$<.004$

A similar pattern is observed in the error patterns. Positive correlations are found for five error types in regular print to the same error types in large print: substitutions +.52 ($p < .006$), mispronunciations +.34 ($p < .05$), words pronounced by the examiner +.71 ($p < .001$), repetitions +.53 ($p < .005$), and total errors +.55 ($p < .004$).

Correlations for four error types: disregard of punctuation, insertions, hesitations, and omissions are too small to have a probability of occurrence by chance less than .05.

For both partially sighted and normally sighted subjects, eight of the 12 factors show a positive relationship between the regular print test and the large print test. This indicates that for both groups of students the subjects who score high on regular print also score high on large print. Two of the four factors which fail to show a positive relationship, hesitations and omissions, are common to both partially sighted and normally sighted subjects. For partially sighted subjects, mispronunciations and words pronounced by the examiner do not relate positively. Disregard of punctuation and insertions do not show correlations for normally sighted subjects.

Repeated measures t-tests comparing the regular print score on each factor to the large print score on

the same factor were calculated for normally sighted subjects to test hypothesis 4 (Table 8). The mean grade level accuracy score for normally sighted subjects using regular print is 4.752 and 5.235 using large print ($p < .003$). The mean scores on the two tests are significantly different with the large print test producing the better results. The mean grade level comprehension scores of 4.891 and 4.883 are the same for both regular print and large print. The mean rate in words per minute for normally sighted students is not markedly different with 115.04 in regular print and 110.87 in large print.

One error type, insertions, differed in regular print and large print with mean error ratio scores of 2.17 and 7.13 ($p < .003$).

No other error scores are markedly different. These include: substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, hesitations, repetitions, omissions, and total errors.

On two factors, accuracy and insertions, the reading performance scores of normally sighted subjects in regular print are different from the large print scores. The large print test produced better results for accuracy and the regular print test produced fewer insertions.

Perhaps of greatest interest is whether or not the use of large print made a positive difference in the case

Table 8: Means, Standard Deviations, t-Values, and Probability Values for t-Tests on Regular Print versus Large Print Scores for Normally Sighted Subjects

Reading Factor	Regular Print Mean	SD	Large Print Mean	SD	t value	p value
Accuracy	4.752	1.250	5.235	1.337	-3.36	<.003
Comprehension	4.891	1.713	4.883	2.004	.02	n.s.
Rate	1115.04	20.76	110.87	14.23	1.00	n.s.
Substitutions	20.91	16.03	17.74	13.84	1.03	n.s.
Mispronunciations	3.96	5.47	4.17	4.49	-.18	n.s.
Words Pronounced by the Examiner	2.83	3.53	3.26	5.02	-.32	n.s.
Disregard of Punctuation	5.17	6.66	4.09	4.05	.66	n.s.
Insertions	2.17	3.10	7.13	6.48	-3.34	<.003
Hesitations	2.96	3.60	2.30	3.69	.59	n.s.
Repetitions	11.48	10.38	10.96	8.63	.27	n.s.
Omissions	3.22	4.35	3.09	5.01	.10	n.s.
Total Errors	51.30	15.05	50.26	16.84	.33	n.s.

of individual students, whether partially sighted or normally sighted. In order to examine this, a difference score of the large print score minus the regular print score was calculated for each subject on each factor measured. Tables 27 and 28 in the Appendix include the difference scores for each of the subjects. In interpreting the difference scores it should be noted that the direction of difference indicating a better score on the large print test changes as the scale of measurement changes for the various factors. For accuracy, comprehension, and rate a plus difference score indicates a better score on the large print test. However, the other factors are measures of errors per thousand words read. For these factors the lower number of errors constitutes the better score. For all these factors a minus difference score indicates a better score on the large print test.

Hypothesis 5 states there is no difference in the differences in reading performance of normally sighted and partially sighted subjects. A t-test of the difference scores for partially sighted subjects compared to the difference scores for normally sighted subjects was used to test this hypothesis (Table 9).

The mean difference score for accuracy of .387 for partially sighted subjects and .483 for normally sighted

Table 9: Means, Standard Deviations, t-Values and Probability Values for t-Tests on Large Print Minus Regular Print Scores for Each Factor Measured for Partially Sighted versus Noramlly Sighted Subjects

Reading Factor	Partially Sighted Mean	SD	Normally Sighted Mean	SD	t value	p value
Accuracy (grade level)	.387	.469	.483	.688	-.55	n.s.
Comprehension (grade level)	-.117	1.688	-.009	1.808	-.21	n.s.
Rate (w.p.m.)	-8.09	20.99	-4.17	20.02	-.65	n.s.
Substitutions	-2.00	12.58	-3.17	14.74	.29	n.s.
Mispronunciations	2.78	6.54	.22	5.76	1.41	n.s.
Words Pronounced by the Examiner	.43	6.56	0.0	2.92	.29	n.s.
Disregard of Punctuation	1.91	7.46	-1.09	7.88	1.33	n.s.
Insertions	2.56	8.02	4.96	7.12	-1.07	n.s.
Hesitations	1.43	11.43	-.65	5.27	.80	n.s.
Repetitions	2.43	9.36	-.52	9.37	1.07	n.s.
Omissions	1.74	6.80	-.13	6.22	.97	n.s.
Total Errors	12.91	24.76	-1.04	15.22	2.30	$<.03$

subjects is not different. For partially sighted subjects the mean difference score for comprehension of -.117 is not different from -.009 for normally sighted subjects. The mean difference for rate in words per minute of -8.09 for partially sighted subjects does not markedly differ from -4.17 for normally sighted subjects. In no case is there a marked difference between the difference scores of partially sighted subjects and normally sighted subjects for accuracy, comprehension or rate.

For one factor, total errors, the differences between large print and regular print are different for normally sighted and partially sighted subjects ($p < .03$). The partially sighted subjects have a mean difference of 12.91 more errors in large print while the normally sighted subjects have a mean difference of 1.04 more errors in regular print.

For eight of the nine error types the differences between large print and regular print scores are not different for partially sighted and normally sighted subjects. These factors are: substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, and omissions.

These findings indicate that for most factors of reading performance the effect of changing the print

size does not produce different effects for partially sighted and normally sighted subjects.

Hypothesis 6: The proportions of normally sighted subjects distributed into groups according to size and direction of difference between reading scores (regular print < large print, regular print = large print, and regular print > large print) is not different from those for partially sighted subjects. X^2 proportion analysis compared the proportions of the two groups of subjects on four factors: accuracy, comprehension, rate and total error ratio. In instructional practice a difference of only one month between the two scores, better in large print or better in regular print, would not be sufficient to justify consideration of a change in instructional practice. Therefore the classification, regular print = large print, was constructed to include a range of scores of plus or minus half a year.

When the accuracy scores were classified into regular print < large print, regular print = large print, and regular print > large print the resulting distribution had an expected frequency less than one in two cells. Siegel (1956) recommends when any cell has an expected frequency of less than one that adjacent categories be combined in order to increase the expected frequencies. In this case the combining of adjacent categories did not provide meaningful data, so a different classifica-

tion was used. The scores were divided into regular print < large print and regular print > large print with the zero, or regular print exactly equals large print, scores eliminated. This classification provided an appropriate 2 x 2 table (Table 10). The proportions of normally sighted subjects distributed into groups according to size and direction of difference between reading accuracy scores is not different from those for partially sighted subjects.

A similar finding applies to the reading comprehension scores. The proportions of normally sighted subjects distributed into groups according to size and direction of difference between reading comprehension scores (regular print < large print, regular print = large print, regular print > large print) is not different from those for partially sighted subjects (Table 11).

An examination of the average oral reading rates of the standardization population for the Gilmore Oral Reading Test by grades (Gilmore, 1952, p. 5) shows that the average increase in rate per grade is approximately 30 words per minute. Following the plan of including a range of plus or minus half a year in the category regular print = large print, this category was designated as $\pm$15 words per minute. Table 12 gives the observed frequencies for size and direction of difference between

Table 10: Observed Frequencies of Subjects Distributed into Groups According to Size and Direction of Difference Between Accuracy Scores

	A < B*	A > B*
Partially Sighted	18	5
Normally Sighted	16	5

$X^2 = .04$ n.s.

*
A represents Regular Print

B represents Large Print

Table 11: Observed Frequencies of Subjects Distributed into Groups According to Size and Direction of Difference Between Comprehension Scores

	$A < B^*$	$A \pm 1.0\ B^*$	$A > B^*$
Partially Sighted	6	12	5
Normally Sighted	7	11	5

$X^2 = .12$ n.s.

*
A represents Regular Print

B represents Large Print

Table 12: Observed Frequencies of Subjects Distributed into Groups According to Size and Direction of Difference Between Rate Scores

	A < B*	A ±15 B*	A > B*
Partially Sighted	3	10	10
Normally Sighted	4	13	6

$X^2 = 1.5$ n.s.

*
A represents Regular Print

B represents Large Print

reading rate scores. The X^2 for the distribution of size and direction of difference between reading rate scores was 1.5 (n.s.).

The Gilmore Oral Reading Test does not give grade level equivalents for errors in oral reading, so that the plan for designating the categories using plus or minus half a year for the regular print = large print category was not possible. Instead the distribution of the normally sighted subjects was used to designate the categories with the range in the regular print = large print category being plus or minus one standard deviation of the normally sighted subjects. Table 13 shows the observed frequencies in these categories. The proportions of normally sighted subjects distributed into groups according to size and direction of difference between errors in oral reading scores (regular print < large print, regular print = large print, regular print > large print) is not different from those for partially sighted subjects.

For all four factors examined: accuracy, comprehension, rate and total errors, the proportions falling into the various categories determined by size and direction of difference are not different for normally sighted and partially sighted subjects.

Table 13: Observed Frequencies of Subjects Distributed into Groups According to Size and Direction of Difference Between Total Error Ratio Scores

	$A < B^*$	$A \pm 1SD\ B^*$	$A > B^*$
Partially Sighted	8	13	2
Normally Sighted	4	15	4

$$x^2 = 2.14 \quad n.s.$$

*
A represents Regular Print

B represents Large Print

Summary

An examination of the relative scores on accuracy and comprehension grade levels within each group reveal that partially sighted subjects score higher on comprehension than accuracy regardless of the print size used. For normally sighted subjects there is some change in the relationship of accuracy and comprehension scores for the regular print and large print tests. In both cases fewer normally sighted subjects than partially sighted subjects scored higher in comprehension than accuracy.

An analysis of oral reading error patterns for the total sample found 36 percent of the errors made are substitutions, 20 percent are repetitions, and 10 percent are mispronunciations. The category having the fewest errors in words pronounced by the examiner, with five percent of the errors.

Among partially sighted subjects a Pearson product moment correlation of each factor measured using the regular print test with the same factor on the large print test found the following factors to be positively related: accuracy, comprehension, rate, substitutions, disregard of punctuation, insertions, repetitions, and total error ratio. Four factors, mispronunciations, words pronounced by the examiner, hesitations, and omissions are not related.

A repeated measures t-test comparing the regular print and large print test scores of partially sighted subjects found three factors: accuracy, mispronunciations and total error ratio, to be different on the two tests. Accuracy is better using the large print test; the regular print test produced fewer mispronunciations and total errors. The other factors measured show no differences: comprehension, rate, substitutions, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions and omissions.

A Pearson product moment correlation of each factor using regular print to the same factor in large print was calculated for normally sighted subjects. A positive correlation was found for the following factors: accuracy, comprehension, rate, substitutions, mispronunciations, words pronounced by the examiner, repetitions, and total error ratio. Four factors are not related: disregard of punctuation, insertions, hesitations, and omissions.

The performance of normally sighted subjects on the regular print test and the large print test were compared using a repeated measures t-test. Mean scores on the two tests are different for accuracy and insertions. The large print test produced better scores on accuracy, while the regular print test produced fewer insertions. There is no difference for the other factors measured: comprehension, rate, substitutions, mispronunciations,

words pronounced by the examiner, disregard of punctuation, hesitations, repetitions, omissions and total error ratio.

Normally sighted subjects were compared to partially sighted subjects on difference scores (large print score minus regular print score) using t-tests. The groups differ on one factor only, total error ratio. The partially sighted subjects had a mean difference of 13 more errors in large print while the normally sighted subjects had a mean difference of one more error using regular print. The two groups do not differ on differences in any other factors: accuracy, comprehension, rate, substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, and omissions.

A chi square proportion analysis compared proportions of normally sighted subjects distributed into groups according to size and direction of differences between reading scores with these proportions for partially sighted subjects. The reading accuracy scores of the two groups were categorized as regular print < large print and regular print > large print. The distributions of the groups are not different. The comprehension, rate, and total error scores were categorized: regular print < large print, regular print = large print, regular print > large print. The normally sighted and partially sighted

subjects do not differ in the distribution of subjects into these categories.

CHAPTER V

SUMMARY AND RECOMMENDATIONS OF THE INVESTIGATOR

The purpose of the present study was to investigate the effect of print size on the reading performance of normally sighted and partially sighted third and fourth grade students. Subjects were 23 normally sighted and 23 partially sighted public school students. Each subject was administered the Gilmore Oral Reading Test, Form A in the regular print edition and Form B in a large print edition. Twelve factors of reading performance were measured: accuracy, comprehension, rate, substitutions, mispronunciations, words pronounced by the examiner, disregard of punctuation, insertions, hesitations, repetitions, omissions, and total errors.

Analysis of the data included Pearson product moment correlations for each factor in regular print to the same factor in large print for partially sighted and for normally sighted subjects, repeated measures t-tests of each factor in regular print to the same factor in large print for partially sighted and normally sighted subjects, t-tests of the large print minus regular print scores for each factor measured for partially sighted versus normally sighted subjects, and chi square proportion analysis comparing the proportions of normally sighted subjects categorized according to size and direction of

difference between reading scores to these proportions for partially sighted subjects on four factors: accuracy, comprehension, rate, and total error ratio.

Six hypotheses examined a total of 64 questions about the effect of print size on the reading performance of normally sighted and partially sighted third and fourth grade students. The significant findings are enumerated and discussed below.

Summary and Discussion

For two thirds of the factors of reading performance tested the scores on the regular print edition relate positively to the scores on the same factor on the large print edition. This is true for both normally sighted and partially sighted subjects.

For both normally sighted and partially sighted students accuracy scores are better using the large print edition. Partially sighted students made fewer mispronunciations and total errors as counted by errors per thousand words read, using the regular print edition. Normally sighted students made fewer insertions per thousand words read using regular print.

The effect of the change in print size differs for normally sighted and partially sighted subjects only in the total error ratio. Partially sighted students have

a larger error ratio in large print whereas normally sighted subjects have a slightly lower error ratio in large print. When each group is classified according to size and direction of differences in scores of the same factor in large print and regular print, the proportions of subjects in the various classifications do not differ for the two groups. These two findings indicate that changing the print size does not affect partially sighted students differently than it affects normally sighted students.

The significant findings seem to be contradictory. For both normally sighted and partially sighted subjects accuracy scores are better using large print, but for partially sighted subjects the total error ratio, which can also be interpreted as a measure of accuracy, is better using regular print.

One possible explanation of this contradiction is that these findings occurred by chance. However, each finding occurs in two separate t-tests which tends to discount chance occurrence. The better accuracy score in large print is found for both normally sighted and partially sighted subjects. The lower total error ratio in regular print is found for partially sighted subjects examined alone and again when this factor becomes evident as compared to normally sighted subjects.

The more likely explanation is that while the accuracy score and the total errors per thousand words read are both measures of accuracy, they measure different things. The Gilmore accuracy score is based on a set value for each reading level, whereas the measure of errors per thousand words read varies as the number of words increases for the more difficult levels. In addition the accuracy score gives positive credit for paragraphs below the levels the child read on the assumption that these paragraphs below the child's reading level would have been read correctly. Only words actually read were counted in the error ratio. The accuracy score serves to rank the student in relation to other students on the basis of grade level, while the error ratio gives more individual information from a range approximating the student's reading level.

Two previous studies examined accuracy in oral reading of partially sighted students. A Stanwix House study (Eakin, 1961) found that reading was not any more accurate for one size than another as measured by the number of errors in a ten minute period of oral reading. This measure differs from both measures of accuracy used in the present study, one of which is better in large print and one of which is better in regular print for partially sighted subjects. Bateman (1963) found that partially sighted students using an enlarged test received higher

accuracy scores than the average established with the norm population of normally sighted students reading the regular print edition. This accuracy score based on the percentage of items correct among those attempted and on reading level is similar to the accuracy score in the present study. The results of the present study suggest that this increase in accuracy may have been an effect of the print size rather than the visual handicap.

In this study as in earlier ones there is a small but insignificant trend for the reading rate of partially sighted students to be faster on the smaller print. Insignificantly faster rate with smaller print was found by Fortner (1943) using 18 and 24 point, Nolan (1959) using 18 and 24 point, and Stanwix House (Eakin, 1961) using 12, 18, and 24 point. In the present study this trend was also evident for normally sighted students. Earlier studies reviewed for normally sighted persons have mixed results. One earlier study (Sykes, 1971) with partially sighted students found slightly faster reading with the larger print when using 10 and 18 point type.

For partially sighted subjects the use of large print increased the incidence of mispronunciation errors, doubling the percentage of this error type. Christenson (1969) found that mispronunciation was more frequent at the frustration reading level for fourth, fifth and sixth grade students. In the present study, errors from

the ceiling paragraph which can be seen as the frustration reading level, were not counted in the error totals. The differentiation between substitution and mispronunciation errors is that substitutions are sensible or real words whereas mispronunciations are nonsense words. An increase in nonsense words seems to indicate readers whose reading makes less sense to them and/or readers who are not attending to the auditory feedback. Perhaps greater attention to the visual stimulus produced less attention to the auditory feedback of the words read. Both these factors along with Christenson's finding of more frequent mispronunciations at the frustration reading level suggest that large print produced reading like that at the frustration level for the partially sighted students.

Normally sighted students made more insertions using large print. An increase in insertions suggests that the readers may have had a tendency to lose the place when reading large print. However, a tendency to lose the place could also be expected to produce an increase hesitations and omissions both of which show slight non-significant decreases in large print. Therefore, no particular significance can be placed on the increase in insertions alone when normally sighted students used large print.

The low number of error types which differ makes additional analysis of the effect of print size on error patterns impossible. The insignificant findings may in part result from the necessarily skewed distribution of error ratios.

The results of the present study may be examined in the light of the question of whether a partially sighted student should use large print materials. The large print test produced better accuracy scores for both normally sighted and partially sighted students, while the regular print test produced fewer total errors for partially sighted students. Since both of these can be seen as measures of accuracy, the differences between them need to be examined. The accuracy score places the student in a group according to a grade level standard whereas the total error ratio is a measure of errors made by an individual within the range of his reading ability. For the special educator the total error ratio is likely to be more important since it measures errors in an individual's reading at a more realistic difficulty level. In this case the better total error ratio in regular print becomes the more important factor to consider.

The other findings also suggest the advantages of regular print for this group of subjects. Of the 12

factors tested, partially sighted subjects have better scores in regular print on nine. Most of these differences are too small to be significant, with only two significant differences. Nevertheless a trend is evident for regular print to produce better results for the partially sighted subjects. On the other hand, the results for normally sighted subjects do not show a clear trend but vary, with some scores better in regular print, some better in large print and comprehension approximately equal. Again, most of the differences are not statistically significantly different. The only way in which the effect of print size differs for normally sighted and partially sighted students is that partially sighted students have a larger error ratio in large print while normally sighted students have a slightly smaller error ratio in large print. It then appears that regular print may have slightly greater beneficial effects for the partially sighted than the normally sighted students.

One possible explanation for these results is that an increase in size of print of necessity decreases the number of letters or words an individual sees in one fixation. A person with a visual handicap is more likely to have a restriction in what he can see, so the decrease in amount seen in one fixation may impose a greater limitation on him.

Limitations of the Study

This section will examine limitations in the interpretation of results of the study and restraints in generalization to other settings. Limitations imposed by the conditions peculiar to the present study which may affect results, must be considered in interpreting the findings.

An examination of the raw scores shows that of the two scores assigned grade level values by the Gilmore test the comprehension scores for both groups, but especially for the partially sighted subjects, tended to be near or over the upper limit of the test to a far greater extent than the accuracy scores. Because the test was not difficult enough for some subjects, differences in comprehension may not have become evident.

It must be kept in mind that the findings which are accepted as significant can not be accepted in terms of absolute sureness. The .05 decision rule used in the present investigation means that a difference great enough to be accepted as significant has one possibility in 20 of occurring by chance only. In this study where a large number of tests were calculated but only a relatively small number of them were significant there is a danger that some of these results are simply chance occurrences. Of the 36 t-tests calculated, six are statistically different. One in 20, or two, of these

tests could have significant results by chance.

For 16 of the t-tests, those involving the specific error types, the distribution is skewed as a result of the type of measure. For each error type the possible scores range from 0 up to any number of errors. For 28 distributions used in 14 of these t-tests, the mode is 0, with 0 comprising a majority of the scores in six of them. This combination of factors, a large concentration of scores at or near an absolute limit at one end of the distribution with scores free to vary at the other end of the distribution has produced non-normal distributions. These non-normal distributions violate one of the major assumptions underlying the t-test, that of normal distributions in the populations. As discussed in Chapter III, Hays states that a normal distribution of the population is the less important of the two assumptions. "By and large however, this assumption (of normal distribution in the populations) may be violated almost with impunity provided that sample size is not extremely small"(Hays, 1963, p. 322). On the basis of this assurance t-tests were used in the present study.

In addition, generalizations from the present study to other situations should consider the limitations imposed by the specific conditions of this study. Conditions relating to print size, type of test or reading materials, length of the test situation, and grade level will be examined.

The sizes of print in the two editions of the test were planned to be quite different. In addition, neither edition had an absolute print size. Applications to situations using lesser differences, or a change in the type of difference, in print size may not be appropriate.

Conditions relating to the instrument used impose other limitations on the study. Because the oral reading task differs from that of silent reading, findings of the present study using an oral reading test may not be true for silent reading. The time in the reading situation was relatively short, producing results which may not be consistent for longer periods of reading, particularly for partially sighted students. The present study was conducted with third and fourth grade students. The partially sighted subjects were chosen to include only students who did not have additional handicaps. Generalizations to other circumstances, such as adolescents or pre-school students, or institutionalized severely handicapped children, may not be appropriate.

Implications for Education

The results of this study support the current trend of increasing use of regular print materials for partially sighted students and suggest not only that the traditional practice of using large print books for partially sighted students may be unnecessary in some cases, but for some

students the regular print may be helpful. In view of these findings and the greatly increased cost of large print materials one can certainly question an automatic assumption that a partially sighted student should have large print materials. Only one normally sighted student performed better on all four major factors using large print and one partially sighted student performed better on all four major factors using regular print (Tables 27 and 28). Most students performed better on some factors in large print and others in regular print. The magnitude of these individual differences was quite variable and cannot be generalized. Although no partially sighted student in the present study was unable to read the regular print, there are some students who can read only large print. Of course, for these students the value of large print is not questioned. It is for those who can read regular print that the question is raised. Each student should be evaluated individually to determine his ability to benefit from large print and regular print. This evaluation should include an analysis of the effect of print size on a variety of factors and the relative importance of these factors for specific materials.

Implications for Further Research

Findings from the present study illuminate the usefulness of various factors as criteria for future

research on the effect of print size. This study points out the differing effects of print size on the different factors of reading performance. Not only were the major factors such as accuracy, comprehension, rate and total error ratio affected in opposite directions for the group as a whole, but also the patterns of the effects are quite individual varying widely in direction and magnitude for each factor. Therefore, a measure which uses only a combination of factors is not suitable, since the effect on one factor may cancel the effect on another. Investigation of the individual patterns of effects could shed light on the question of whether an individual should read regular print or large print. Such an investigation would need either a large enough number of subjects to allow repetition in the patterns, or a study over time to investigate the stability of these patterns within individuals.

Of the various factors of reading performance examined, measures of accuracy appear to be most sensitive to the effect of changes in print size.

The size of the type varied in both the regular print and large print editions of the test used in the present study. Further investigation in which print size is held constant for each edition could increase the possibility of demonstrating a difference, or lack of it, between the two.

Subjects in the present investigation were third and fourth grade students who are just beginning to apply their reading skill as independent readers. Investigation of the effect of print size on older students with more established reading skills would be worthwhile.

Summary

This investigation of the effect of print size found few differences between the use of regular print and large print with normally sighted and partially sighted third and fourth grade students. Both normally sighted and partially sighted students received better accuracy scores using large print. Partially sighted students had fewer mispronunciations and total errors using regular print, while normally sighted students exhibited fewer insertions using regular print. The effect of change in print size differs for partially sighted and normally sighted students only in the total errors. Partially sighted students have more total errors using large print and normally sighted students have slightly less total errors using large print.

Since partially sighted students as a group experience little positive effect of change to large print, and in fact register a slight negative effect, the traditional practice of routinely providing large print materials for partially sighted students is questioned.

On the other hand, no advantage emerged favoring the use of regular print for the partially sighted as a group. Inspection of individual performance scores shows great variation. Therefore, the most appropriate procedure would be to make the decision on the use of large print on an individual basis.

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APPENDIX

Table 14: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Accuracy Scores

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	4.265	1.534	2.1	9.4	7.3
Large Print	4.652	1.639	2.0	9.8+	7.9
Normally Sighted					
Regular Print	4.752	1.250	3.0	7.0	4.0
Large Print	5.235	1.337	3.2	8.6	5.4

Table 15: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Comprehension Scores

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	5.483	2.119	2.6	9.8+	7.3
Large Print	5.365	2.242	1.3	9.8+	8.6
Normally Sighted					
Regular Print	4.891	1.713	2.6	9.8	7.2
Large Print	4.883	2.004	2.0	9.8+	7.9

Table 16: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Rate Scores in Words Per Minute

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	101.48	21.09	66	144	78
Large Print	93.39	28.54	48	168	120
Normally Sighted					
Regular Print	115.04	20.76	78	168	90
Large Print	110.87	14.23	84	138	54

Table 17: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Substitutions Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	24.96	17.06	5	71	66
Large Print	22.96	18.54	0	65	65
Normally Sighted					
Regular Print	20.91	16.03	5	76	71
Large Print	17.74	13.84	0	49	49

Table 18: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Mispronunciations Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	1.56	3.14	0	12	12
Large Print	4.35	5.87	0	18	18
Normally Sighted					
Regular Print	3.96	5.47	0	18	18
Large Print	4.17	4.49	0	14	14

Table 19: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Words Pronounced By the Examiner Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	1.74	4.01	0	10	10
Large Print	1.74	3.60	0	16	16
Normally Sighted					
Regular Print	2.83	3.53	0	17	17
Large Print	3.26	5.02	0	12	12

Table 20: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Disregard of Punctuation Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	3.96	6.06	0	25	25
Large Print	5.87	7.58	0	23	23
Normally Sighted					
Regular Print	5.17	6.66	0	25	25
Large Print	4.09	4.05	0	12	12

Table 21: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Insertions Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	2.52	4.77	0	17	17
Large Print	5.09	8.48	0	36	36
Normally Sighted					
Regular Print	2.17	3.10	0	10	10
Large Print	7.13	6.48	0	23	23

Table 22: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Hesitations Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	5.30	10.53	0	51	51
Large Print	6.74	8.69	0	26	26
Normally Sighted					
Regular Print	2.96	3.60	0	10	10
Large Print	2.30	3.69	0	12	12

Table 23: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Repetitions Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	10.17	8.27	0	26	26
Large Print	12.61	8.69	0	31	31
Normally Sighted					
Regular Print	11.48	10.38	0	34	34
Large Print	10.96	8.63	0	26	26

Table 24: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Omissions Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	3.17	4.43	0	12	12
Large Print	4.91	6.20	0	24	24
Normally Sighted					
Regular Print	3.22	4.35	0	17	17
Large Print	3.09	5.01	0	22	22

Table 25: Means, Standard Deviations, Minimum Scores, Maximum Scores and Ranges of Total Errors Per Thousand Words Read

Group	Mean	SD	Minimum	Maximum	Range
Partially Sighted					
Regular Print	52.48	17.07	29	102	73
Large Print	65.39	30.96	0	154	154
Normally Sighted					
Regular Print	51.30	15.05	29	84	55
Large Print	50.26	16.84	23	86	63

Table 26: Total Number of Errors Categorized by Error Type for Each Treatment Group and Total Sample

Error Type	Partially Sighted RP	Partially Sighted LP	Normally Sighted RP	Normally Sighted LP	Total Sample
Substitutions	121	89	101	93	404
Mispronunciations	14	30	39	28	111
Words Pronounced by the Examiner	16	14	14	11	55
Disregard of Punctuation	20	24	25	24	93
Insertion	11	21	14	36	82
Hesitations	18	27	23	15	83
Repetitions	47	59	69	54	229
Omissions	18	19	19	20	76
Total Errors	265	283	304	281	1133

Table 27: Large Print Score Minus Regular Print Score for Normally Sighted Subjects

Subject	Accuracy	Comprehension	Rate	Total Error Ratio
N 1	.8[x]	1.2[x]	- 6	- 2[x]
N 2	.6[x]	.1[x]	-54	18
N 3	0	-1.1	- 6	28
N 4	1.3[x]	2.3[x]	- 6	-14[x]
N 5	.2[x]	1.4[x]	-24	18
N 6	2.2[x]	.8[x]	-18	- 6
N 7	.2[x]	-.4	24[x]	-25[x]
N 8	.3[x]	-.2	-12	- 5[x]
N 9	-.3	3.1[x]	6[x]	0
N10	1.0[x]	0	6[x]	-22[x]
N11	1.1[x]	.2[x]	-36	- 6[x]
N12	.6[x]	-.6	6[x]	-20[x]
N13	-.4	-2.5	6[x]	- 2[x]
N14	.3[x]	3.1[x]	6[x]	14
N15	.5[x]	-1.1[x]	24[x]	-29[x]
N16	-.5	-1.9	6[x]	- 2[x]
N17	.5[x]	-1.0	-30	10
N18	-.1	-4.4	18[x]	1
N19	.5[x]	1.5[x]	0	19
N20	0	1.0[x]	0	-1[x]
N21	.7[x]	-2.4	6[x]	-15[x]
N22	1.1[x]	-.7	-30	10
N23	-.5	-.8	18[x]	7

[x]indicates a better performance in large print

Table 28: Large Print Score Minus Regular Print Score for Partially Sighted Subjects

Subject	Accuracy	Comprehension	Rate	Total Error Ratio
P 1	.2[x]	-2.2	48[x]	-42[x]
P 2	.4[x]	.6[x]	0	8
P 3	.8[x]	1.6[x]	-18	- 8[x]
P 4	.3[x]	1.0[x]	-12	12
P 5	-.5	2.0[x]	-30	59
P 6	1.0[x]	-.8	-24	0
P 7	.7[x]	-.1	-12	12
P 8	1.0[x]	.2[x]	-18	1
P 9	.4[x]	0	-48	57
P10	.8[x]	1.6[x]	-12	- 7[x]
P11	-.1	-.8	30[x]	44
P12	.5[x]	-2.6	-18	11
P13	.3[x]	-.8	-24	35
P14	-.2	-3.9	0	14
P15	.6[x]	3.1[x]	-12	- 1[x]
P16	.2[x]	1.4[x]	6[x]	28
P17	.5[x]	0	-18	- 1[x]
P18	.6[x]	-1.0	18[x]	- 4[x]
P19	-.8	.6[x]	0	22
P20	.8[x]	1.6[x]	- 6	- 4[x]
P21	.8[x]	-2.3	-18	-16[x]
P22	-.1	-1.7	-30	52
P23	.8[x]	- .2	12[x]	25

[x]indicates a better performance in large print

Division of Special Education
Boston College
Chestnut Hill, Massachusetts 02167
February 29, 1972

Dear Educator:

As a Ph.D. candidate at the University of Minnesota, I am currently gathering data for my doctoral thesis. The purpose of this letter is to ask your help in obtaining students whom I may test to get the necessary data.

Miss Marjorie Frye and Mr. John Stager of the Division of Special Education of the State Department of Education for the Commonwealth of Massachusetts, have agreed to send this letter to educators in Massachusetts who would be likely to have third and fourth grade partially sighted students, the group of students I am looking for.

The purpose of my thesis study is to investigate the effect of print size on the reading performance of normally sighted and partially sighted third and fourth grade students. To carry out this study I must test 20 partially sighted and 20 normally sighted third and fourth grade students using the Gilmore Oral Reading Test in regular edition and in large print.

With your permission I would like to come to your school to test your partially sighted third and fourth grade students and one normally sighted student for every partially sighted student chosen at random from the same classroom as the partially sighted student.

For this study partially sighted students are defined as having corrected vision of 20/70 or less in the better eye and using print as the primary medium of education. You will note that this includes legally blind students. It is not necessary that the partially sighted student be one who is served by a teacher of the visually handicapped.

The following data will be recorded on each student: an identifying number, birth date, grade, sex, school, visual Acuity and scores on the Gilmore Oral Reading Test. Please note that the students will not be identified by name, so that readers will not know the test results of a specific child.

I will administer the Gilmore Oral Reading Test to each student individually and where necessary, check his visual acuity using the Snellen Chart. The total time required for each child should be approximately an hour.

Because it is often difficult to phone me, I have enclosed a post card on which you can write your name, phone numbers and address. If you wish to contact me you may write or call Ouida Fae Morris, Supervisor, Education of the Visually Handicapped, Division of Special Education, Boston College, Chestnut Hill, Massachusetts, 02167. The phone is 969-0100, ext. 2395. My home phone is 891-7160. I will be happy to set up a time to come to your school to discuss the procedure and to test students.

Your cooperation and that of the students' teachers would be deeply appreciated.

Sincerely yours,

Ouida Fae Morris

OFM/pj
Enclosure

The Commonwealth of Massachusetts

Department of Education

182 Tremont Street, Boston 02111

M E M O R A N D U M

March 2, 1972

TO: Teacher of Visually Handicapped

FROM: Marjorie J. Frye, John D. Stager, Supervisors of Visually Handicapped Children

SUBJECT: Cooperation regarding attached proposed study of Comparative Reading Skills

We respectfully urge your participation, if possible, in the study(described in attached letter)to be conducted by Miss Ouida Fae Morris, faculty member of the Division of Special Education and Rehabilitation, Boston College.

In order to obtain proper clearance for this project, we ask that you discuss the matter with your school Superintendent(s). If permission is given, we urge your cooperation with Miss Morris. In any event, please be in touch with Miss Morris via the enclosed postcard.

We believe that the results of this study will be of value and interest to all of us in the field of education of the visually handicapped. Thank you for your consideration.

HV1737 Morris, Ouida Fae. c.1
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